ORIGINAL

Project Manual for Construction of

CENTENNIAL PARK

RECEIVED
APR 12 2010
DEPT. OF ENVIRO. QUALITY
WASTE & UNDERGROUND TANK
MANAGEMENT BUREAU

prepared for

City of Helena
Helena, Montana

prepared by

CARL THUESEN ASLA

in association with

Great West Engineering, Inc.
Design 3 Engineering
PRZ Sports Turf Consulting

April 2, 2010

Set No. 11

HELENA
PO Box 4817 ▪ 2501 Belt View Drive
Helena, MT 59604
406.449.8627 ▪ Fax 406.449.8631

GreatWest engineering

April 12, 2010

Mary Louise Hendrickson
Montana Department of Environmental Quality-Solid Waste Program
PO Box 200901
Helena, MT 59620-0901

RE: Centennial Park Master Plan
Bid Documents Transmittal

Dear Mary Louise:

Enclosed you'll find two copies of the Centennial Park Master Plan bid package. As we discussed the project is currently out for bid. Could you please review the document to verify compliance with the intent of the December 2009 approved Post Closure Plan?

If you have any comments that need address in the bid documents we will issue an addendum. If you comments are after bid opening we will address them in a change order.

Please contact me if you have any questions or concerns.

Sincerely,

Great West Engineering, Inc.,

Todd Kuxhaus, PE
Project Manager

Enclosures: Final Construction Plans

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WASTE & UNDERGROUND TANK
MANAGEMENT BUREAU

BILLINGS
115 N Broadway
Suite 500
Billings, MT 59101
406.652.5000
Fax 406.248.1363

BOZEMAN
602 Ferguson
Suite 1
Bozeman, MT 59718
406.587.0504
Fax 406.587.0541

Planholders List

CENTENNIAL PARK
Helena, Montana

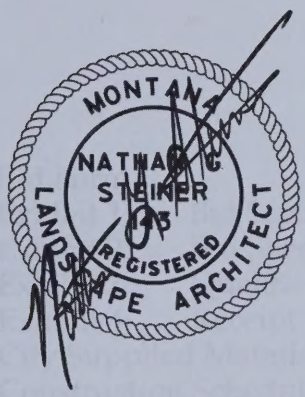
4/2/10

First Name	Last Name	Company	Address	City	State	Zip	Phone	Fax	Set
Gery	Carpenter	City of Helena	316 N. Park Ave.	Helena	MT	59623	406-447-8382	406-447-8480	1-5
Nathan	Steiner	Carl Thuesen ASLA	1925 Grand Ave, Suite 105	Billings	MT	59102	406-252-5545	406-245-9855	6
Todd	Kuxhaus	Great West Engineering, Inc.	2501 Belt View Drive	Helena	MT	59601	406-495-6167	406-449-8631	7-8
Garth	Stevens	Design 3 Engineering	946 Summit View Way	Stevensville	MT	59870	406-777-3166	406-777-0963	9
Mary	Hendrickson	Montana DEQ	1520 East Sixth Ave.	Helena	MT	59620-0901	406-444-1808	406-444-1374	10-11
Jonah	Webb	2M Company, Inc.	1215 Cordova	Billings	MT	59101	406-245-3008	406-259-4841	12
Ryan	Susott	Midland Implement Co. Inc.	5650 Alloy South	Missoula	MT	59808	800-288-3448	406-721-2899	13
		Missoula Plans Exchange	Box 3109	Missoula	MT	59806	406-549-5002	406-721-2941	14
		Builders Exchange of Billings	2050 Broadwater Avenue Suite A	Billings	MT	59102	406-652-1311	406-652-1391	CD1
		Bozeman Plan Library	2016 Glikerson Drive #A	Bozeman	MT	59715	406-586-7653	406-586-4062	CD2
		Montana Contractors Assn.	Box 4519	Helena	MT	59604	406-442-4162	406-449-3199	CD3
		Flathead Builders Exchange	1440 MT Hwy 35 East, Suite B	Kalispell	MT	59901	406-755-5888	406-755-5896	CD4
		Great Falls Builders Exchange	202 Second Ave. S.	Great Falls	MT	59405	406-453-2513	406-727-7548	CD5

Project Manual for Construction of

CENTENNIAL PARK

Helena, Montana



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Carl Thuesen, ASLA
Golf Course Architecture - Landscape Architecture
1925 Grand Avenue, #105
Billings, Montana 59102

406/252-5545

April 2, 2010

Project Manual for Construction of

CENTENNIAL PARK
Helena, Montana

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CITY OF HELENA

********** REQUEST FOR BID **********

The City is requesting sealed bids for the Centennial Park Project, **Project No. PR8914.** To be considered for award, the bid must state the name and number of the project, be addressed to the Clerk of Commission, City of Helena, 316 North Park Avenue, Helena, Montana 59623 and be received by **2:00 P.M.** local time on **April 27, 2010**, at which time the bids will be publicly opened and read. No bid may be withdrawn after the scheduled time of the public opening of bids. The opening and reading of the bids will occur in Room 326 of the City-County Building, 316 North Park Avenue, Helena, Montana.

The proposed project consists of development of Centennial Park including dirt work, parking lots, trails, athletic fields, utility installation, irrigation and landscaping. This project contract is being made under the MT Reinvestment Act of 2009 and requires compliance with the Montana Commerce Department's Local Government Infrastructure Program Guidelines.

Plans, specifications, and Instructions to Bidders are available from the Landscape Architect, Carl Thuesen ASLA for a refundable deposit of $100.00. Contact Nathan Steiner at (406)252-5545. Documents must be returned within ten (10) days after the bid opening in re-usable condition, including addenda.

A pre-bid conference for this project will be held on **April 15, 2010 at 10:00 A.M.**, in Room 326 of the City-County Building, 316 North Park Avenue, Helena, Montana. **To be considered a responsible bidder, attendance at the pre-bid conference by all general contractors is mandatory. Failure to attend will result in the bid of non-attending bidder being rejected.**

Each bidder shall expressly covenant in the bid that if the bidder is awarded the contract, the bidder will, within 15 days after the bid is awarded, enter into a formal contract and give an approved performance bond and a labor and materials payment bond to secure the performance of the terms and conditions of the contract. Each bid must be accompanied by bid security payable to the *City of Helena* for ten percent (10%) of the total amount of the bid. Bid security provided in a form specified in §18-1-203, MCA, which includes, but is not limited to, certified check, cashier's check, bank draft, bid bond, guaranty bond, or surety bond, constitutes compliance with this requirement. The bid security protects and indemnifies the City against the failure or refusal of the successful bidder to timely enter into the contract.

The City reserves the right to reject any or all proposals received, waive informalities, postpone the award of the contract for a period not to exceed SIXTY (60) days, and accept the lowest responsive and responsible bid that is in the best interest of the City.

Authorized and approved by:
Gery Carpenter, Community Facilities Director **3/31/10**

PLEASE ADVERTISE ON: April 4th, 11th, 18th and 21st.

Revised 10/19/09

INSTRUCTIONS TO BIDDERS

BIDS: All bids must be made on the forms provided in this bound copy of the Contract Documents. All bids must be legibly written in ink with all prices given in figures and total bid amount given in words and figures. No alterations by erasures or interlineations will be permitted in bids or in the printed forms. Each bid shall be enclosed in a sealed envelope addressed to: Clerk of the City Commission, 316 North Park Avenue, Helena, Montana 59623, and endorsed on the outside of the envelope with the words:

Centennial Park Project
PROJECT NO. PR8914

Bids shall be strictly in accordance with the prescribed form. Any modifications thereof or deviations therefrom may be considered as sufficient cause for rejection. Bids carrying riders or qualifications to the bid being submitted may be rejected as irregular.

BID SECURITY: To be considered, the bid must be accompanied by a bid security unconditionally payable to the *City of Helena* for ten percent (10%) of the total amount of the bid. Each Bidder shall expressly covenant in the bid that if the Bidder is awarded the contract, the Bidder will, within 15 days after the bid is awarded, enter into a formal contract and give an approved performance bond and a labor and materials payment bond to secure the performance of the terms and conditions of the contract. Bid security must be provided in a form specified in §18-1-203, MCA, which includes, but is not limited to, certified check, cashier's check, bank draft, bid bond, guaranty bond, or surety bond. Bid security through a bid, guaranty or surety bond must be issued by a surety company authorized to do business in the State of Montana. The bid security protects and indemnifies the City against the failure or refusal of the successful Bidder to timely enter into the contract.

SIGNATURE OF BIDDERS: Each bid must be signed in ink by the Bidder with the Bidder's full name and business address or place of residence. If the Bidder is a firm or partnership, the name and residence of each member must be inserted. If the bid is submitted by or in behalf of a corporation, it must be signed in the name of the corporation by a corporate official authorized to bind the corporation and who shall also affix the corporate seal of the corporation to the bid. Any bid by a corporation signed by a person other than a corporate officer must be accompanied by a power of attorney showing that person's authority to sign for the corporation.

ONLY ONE PROPOSAL: No Bidder may submit more than one bid. Two bids under different names will not be received from one firm, partnership, association, or corporation.

RESPONSIBILITY OF AGENT: Any person signing a bid as the agent of another, or of others, may be required to submit satisfactory evidence of authority to so sign.

TITLE: The position title of any person executing the bid or Agreement shall be clearly indicated beneath the signature.

QUALIFICATIONS OF BIDDERS: The Bidder may be required to submit satisfactory evidence that Bidder has practical knowledge of the particular work bid upon and has the necessary financial resources to complete the proposed work.

In determining if a Bidder is a responsible bidder, consideration will be given as to whether the Bidder involved: (a) maintains a permanent place of business; (b) has adequate plant and equipment to do the work properly and expeditiously; (c) has a financial status suitable to meet obligations incident to the work; and (d) has experience in projects of comparable scope and complexity that were satisfactorily completed.

Each Bidder may be required to show that previous work performed by that Bidder has been handled in such a manner that there are no just or proper claims pending against such work. A Bidder will not be acceptable if that Bidder is engaged on any other work that impairs the financial ability to perform the work. A Bidder may demonstrate financial ability by meeting all requirements herein stipulated, when requested.

Bidder is not deemed a responsible bidder if Bidder is delinquent in payment of property taxes or special improvement district assessments for at least six (6) months.

Any Bidder required by the Helena City Code to have a general business license in the City of Helena must obtain it before a bid can be awarded to a bidder.

EXAMINATION OF CONTRACT DOCUMENTS AND SITE: Before submitting a bid, each Bidder should: (a) examine the Contract Documents thoroughly; (b) visit the site to become familiar with location conditions that may in any manner affect cost, progress, or performance of the work; (c) become familiar with federal, state and local laws, ordinances, rules, and regulations that may in any manner affect cost, progress, or performance of the work; and (d) study and carefully correlate Bidder's observations with the Contract Documents.

Each Bidder may, upon request, examine those reports of investigations and tests of subsurface and latent physical conditions at the site, if any, which have been relied upon in preparing the drawings and specifications. These reports are not guaranteed as to accuracy or completeness, nor are they part of the Contract Documents. Before submitting the bid each Bidder will, at Bidder's own expense, make such additional investigations and tests deemed necessary to determine that the bid for performance of the work is in accordance with the time, price, and other terms and conditions of the Contract Documents.

Upon request, City will provide each Bidder access to the site to conduct such investigations and tests each Bidder deems necessary for submission of a bid. Any administrative requirements and associated costs of such investigations are the responsibility of each Bidder.

The lands upon which the work is to be performed, rights-of-way for access thereto, and other lands designated for use in performing the work are identified in the specifications or on the drawings.

The submission of a bid will constitute an incontrovertible representation by a Bidder that the Bidder has complied with every requirement of this section and that the Contract Documents are sufficient in scope and detail to indicate and convey understanding of all terms and conditions for performance of the work.

INTERPRETATION OF CONTRACT DOCUMENTS: If any person contemplating submission of a bid for the proposed contract is in doubt as to the true meaning of any part of the specifications or other proposed Contract Documents, that person may submit a written request to the City for an interpretation thereof. The person submitting the request will be responsible for its prompt delivery. Any interpretation of the proposed documents will be made only by an addendum duly issued and a copy of any such addendum will be mailed or delivered to each person receiving a set of such documents.

TIME OF COMPLETION: The time of completion of the work is a basic consideration of the contract. It will be necessary that each Bidder satisfy the City of the Bidder's ability to complete the work within the stipulated time.

ADDENDA: Any addenda issued during the time of bidding, or forming a part of the Contract Documents loaned to Bidder for the preparation of Bidder's proposal, shall be covered in the bid and shall be made a part of the Agreement. Receipt of each addendum shall be acknowledged in the bid. Any bid in which all issued addenda are not acknowledged will be considered incomplete and will not be read.

WITHDRAWAL OF BID: No Bidder may withdraw any bid for a period as specified in the Request For Bid after the date and hour set for the opening declared herein. Prior to that time, Bidder may withdraw a bid by written request. The request to withdraw a bid must be signed in the same manner and by the same person or persons who signed the bid.

SUBCONTRACTORS: Within seven (7) days after bids are opened, the apparent low Bidder and any other Bidder so requested, shall submit a list of all subcontractors Bidder expects to use in the work.

An experience statement with pertinent information as to similar projects and other evidence of qualification shall be furnished for each named subcontractor if requested by the City. If the City or the project engineer, after due investigation, has reasonable objection to any proposed subcontractor, they may, before giving the Notice of Award, request the apparent low Bidder to submit an acceptable substitute. Refusal to substitute a subcontractor may result in Bidder not being considered a responsible Bidder. Bidder's refusal to substitute will not constitute grounds for forfeiture of bid security.

Bidder shall not be required to employ any subcontractor against whom Bidder has a reasonable objection.

The subcontractors listed by Bidder and accepted by City prior to the Notice of Award will be used in the performance of the work, unless otherwise agreed to in writing by City.

ACCEPTANCE AND REJECTION OF BIDS: The City reserves the right to accept or reject the bids in the best interest of the City. The City reserves the right to waive informalities and irregularities in any bid submitted, to reject non-conforming, non-responsive or conditional bids, to correct arithmetic errors without changing unit price, and postpone awarding of the contract for a period not exceeding sixty (60) days.

AWARD OF CONTRACT: If the contract is to be awarded, City will award the contract to the responsible Bidder whose bid is responsive and conforms with all material terms and conditions of the bidding documents and proposed Contract Documents, is lowest in price, is in the best interest of the project, and other factors considered. The award will be based on the lowest responsive cumulative base bid plus any added alternate schedules the City determines to include with the project. If the contract is awarded, the award will be made within the period specified in the Request For Bid. The successful Bidder will be notified by letter mailed to the address shown on the bid that the bid has been accepted and that Bidder has been awarded the contract.

CANCELLATION OF AWARD: The City reserves the right to cancel the award of any contract at any time before the complete execution of the Agreement by all parties without any liability against the City.

PERFORMANCE BOND; LABOR AND MATERIALS BOND: The Bidder to whom the contract is awarded will be required to furnish a performance bond and a labor and materials bond, in favor of the City, issued by a surety company licensed in this state. The bonds must be in an amount equal to one hundred percent (100%) of the Agreement amount.

The bonds must be executed on the forms bound in the Contract, signed by a surety company licensed in the State of Montana and acceptable as a surety to the City, and countersigned by a Montana resident agent.

One copy of a power of attorney certified to include the date of the bonds must be filed with the City.

INSURANCE: The successful Bidder, as part of the Agreement, shall provide liability insurance and maintain required workers' compensation coverage. Bidder shall provide proof of these through either a certificate of insurance or a current copy of Bidder's policy.

EXECUTION AND APPROVAL OF AGREEMENT: The Agreement shall be signed by the successful Bidder and returned, together with the contract bonds, within the time shown on the bid. If the Agreement is not executed by the City within fifteen (15) days following receipt from Bidder of the signed Agreement and bonds, Bidder has the right to withdraw the bid without penalty. The Agreement is not effective until it has been fully executed by all of the parties thereto.

FAILURE TO EXECUTE AGREEMENT: Failure to execute the Agreement and furnish a performance bond and payment bond shall be just cause for annulment of the award. In the event of such annulment, the bid guarantee shall be forfeited to the City, not as a penalty but as liquidation of damages sustained. Award may then be made to the next lowest responsible and qualified Bidder, or the work may be re-advertised as the City may decide.

BOUND COPY OF CONTRACT DOCUMENTS: None of the Instructions to Bidders, Bid Form, bond forms, Agreement, contract stipulations, or other specifications shall be removed from the bound copy of the Contract Documents prior to submission of bid.

PAYMENT: Payment for all work performed under the Agreement will be made by the City within the time period specified in and in accordance with the procedures outlined therein.

PREVAILING WAGE RATES: In all public works contracts with the City, contractors and their subcontractors shall pay for each job classification the standard prevailing wage rate, including fringe benefits. The standard prevailing wage rate as used herein means the standard prevailing rate of wages in the locality where the work is to be performed as determined by the Montana Commissioner of Labor & Industry pursuant to §18-2-402, MCA, and as bound herein. The Bidder and Bidder's subcontractors are directed to the Montana Commissioner of Labor & Industry for information on the standard prevailing rate of wages applicable to this project within this area.

PAYROLL RECORD MAINTENANCE: In public works contracts, the contractor and subcontractors must maintain payroll records in a manner readily capable of being certified for submission under §18-2-423, MCA, for not less than three (3) years after the completion of work on the project.

POSTING: Contractor shall post in a prominent and accessible place on the site of the work a legible statement of all wages and fringe benefits to be paid to workers on the project.

MONTANA CONTRACTORS' GROSS RECEIPTS TAX: In accordance with Title 15, Chapter 50, MCA, the City shall withhold, in addition to other amounts withheld as provided by law or specified herein, one percent (1%) of all payments due the Contractor and shall remit such monies to the Montana Department of Revenue.

MONTANA LABOR PREFERENCE: Bidder must give preference to the employment of bona fide residents of Montana in the performance of the work.

NON-DISCRIMINATION: In accordance with law, Bidder shall agree not to discriminate against any client, employee, or applicant for employment or for services because of race, color, religion, creed, political ideas, sex, age, marital status, physical or mental disability, or national origin, with regard to, but not limited to, the following: employment upgrading, demotion or transfer, recruitment or recruitment advertising, layoff or termination, rates of pay or other forms of compensation, selection for training, or rendition of services.

It is further understood that any vendor who is in violation of this clause shall be barred forthwith from receiving awards of any purchase from the City of Helena unless a satisfactory showing is made that discriminatory practices have ceased, and the recurrence of such acts is unlikely.

PROJECT DRAWINGS: The project drawings consist of 63 sheets and the cover sheet is titled: Centennial Park Project drawings are contained under a separate cover.

CONSTRUCTION AGREEMENT

This **Construction Agreement** is made this ____day of _____, 20___, by and between the **CITY OF HELENA, MONTANA**, a municipal corporation organized and existing under the laws of the State of Montana, 316 North Park Avenue, Helena, Montana 59623 (**"City"**), and _____, a _____, of _____, (**"Contractor"**).

Recitals

A. The City issued a Request For Bid for the construction project known as Centennial Park Project ("Construction Project") pursuant to the requirements of all applicable statutes, rules, regulations, and ordinances.

B. The City analyzed all responses to the Request For Bid received pursuant to its standard practices and the requirements of all applicable statutes, rules, regulations, and ordinances.

C. The City awarded the bid to Contractor on _____, pursuant to the terms and conditions of this Agreement.

NOW THEREFORE, in consideration of the covenants, agreements, representations, and warranties contained herein, the parties agree as follows:

Agreement

1. Work to be Performed:

a. A description of the Construction Project and Contractor's duties is set forth in the Request For Bid and Bid Form as accepted by City, which are attached hereto and incorporated herein by this reference, and the drawings, plans, and specifications provided by the City and its architects and engineers. The Bid Form is attached here as **Exhibit A**.

b. Prior to the commencement of any work on the Construction Project, Contractor's representatives and City's representatives shall hold a meeting to establish a working understanding among the parties as to the scope of the Construction Project and duties of the Contractor. At this meeting, Contractor and City shall resolve any outstanding issues related to the plans, designs, drawings, and specifications. If the parties are unable to resolve these issues and the City fails, refuses, or is unable to approve the same, no work shall commence on the Construction Project until such issues are resolved and the City approves the related plans, designs, drawings, and specifications.

c. Except as provided elsewhere in this Agreement, Contractor shall furnish all the labor, materials, equipment, tools, and services necessary to perform and complete the Construction Project.

d. During work on the Construction Project, and as part of the final completion of the Construction Project, Contractor shall clean up the Project site, including the removal and satisfactory disposal of all waste, garbage, excess materials, equipment, temporary buildings, the removal or grading of all embankments made for construction purposes, the filling in of all excavations, and the performance of any other work necessary to restore the site to at least as good order and condition as at the commencement of the Construction Project.

2. City-Supplied Materials: City will supply the materials set forth on Exhibit B attached hereto.

3. Time of Performance:

a. Contractor shall begin the Construction Project after receiving a Notice to Proceed from City and shall complete the Construction Project within Three Hundred (300) calendar days of the starting date stated in the Notice to Proceed. The various phases of the Construction Project shall be completed pursuant to the Construction Schedule attached hereto as **Exhibit C** and incorporated herein by this reference. Time is of the essence of completion of all work and each phase of the Construction Project.

b. The Construction Schedule is subject to the City's approval. Contractor's construction plan, methods of operation, materials used, and individuals and subcontractors employed (collectively "Contractor's Resources") are subject to the City's approval at all times during the term of this Agreement, and must be such as to ensure the completion of the work in compliance with the deadlines set in the Construction Schedule during the term of this Agreement. In the event the City determines the Contractor's Resources are inadequate to meet the approved Construction Schedule, the City may order the Contractor to accelerate its performance to give reasonable assurances of timely completion and quality results. Acceleration under this section shall not be deemed a Change Order as defined in Section 5b below and the Contractor shall receive no equitable adjustment for such acceleration. Nothing in this section shall be interpreted to relieve the Contractor of its duties and responsibilities to plan for and complete the work in a timely manner according to the Construction Schedule.

4. Liquidated Damages: If the Construction Project is not completed within the time provided by this Agreement, the City may deduct for each day the Construction Project remains uncompleted the sum of Five Hundred Dollars ($500.00) from the compensation hereinafter specified and retain that sum as payment for liquidated damages sustained by reason of the Contractor's failure to complete the Construction Project on time.

5. Compensation:

a. City shall pay to Contractor, and Contractor shall accept as full payment for the performance of this Agreement and the Construction Project, the amount of _____ ($_____), as paid in accordance with **Exhibit D**, Compensation Schedule, attached hereto.

b. If work not included within the original Scope of Work documents is requested by City, such additional work and the related compensation shall be agreed to in writing by both parties prior to commencement of the additional work ("Change Order") pursuant to the Change of Work Specifications set forth on **Exhibit E** attached hereto.

c. Monthly progress payments and final payment will be made only in accordance with the terms of the Compensation Schedule. All invoices must be submitted to the City's Representative.

d. City shall retain five percent (5%) of the total amount of compensation to be paid to the Contractor to ensure compliance with the terms and conditions of this Agreement and the timely completion of the Construction Project and any and all "punch list" items ("Retainage Amount"). At all times the City will retain no less than One Thousand Dollars ($1,000) until termination of this Agreement. The Retainage Amount shall be paid to Contractor upon the City's final approval of the Construction Project and agreement that all work required to be performed on the Construction Project is complete and satisfactory to the City in accordance with the Compensation Schedule. This provision does not prevent the Contractor from seeking withdrawals of the Retainage Amount in excess of One Thousand Dollars ($1,000), pursuant to the requirements of §18-1-301, MCA.

e. Upon acceptance of final payment and for other good and valuable consideration, Contractor shall release and forever discharge City, its officers, agents, and employees of and from any and all claims, demands, actions, causes of action, obligations, and liabilities of every kind and character whatsoever, in law and in equity, whether now known or in the future discovered, arising from or related to this Agreement or the Construction Project that Contractor may have or assert against City, its officers, agents, and employees.

6. Inspection and Testing:

a. City has the right to inspect and test any and all work performed by Contractor on the Construction Project. Contractor shall allow City and its agents access to the Construction Project at all times and shall provide every reasonable facility for the purpose of such inspection and testing, including temporarily discontinuing portions of the work or uncovering or taking down portions of the finished work. Any inspection and testing performed by the City and its agents is for the sole benefit of the City and shall not relieve the Contractor of its duty, responsibility, and obligation to ensure that the work strictly complies with the Agreement terms and conditions and all applicable laws and building and safety codes. City's inspection and testing shall not be deemed or considered acceptance by the City of any portion of the Construction Project. City's inspection and testing shall not serve to nullify, amend, or waive any warranties provided by the Contractor under this Agreement.

b. Contractor shall, without charge, replace any material or correct any work found by the City or its agents to be defective or otherwise not in compliance with the terms and conditions of this Agreement. In the event Contractor fails to replace or correct any defective work or materials after reasonable written notice by the City to do

so, the City may take such corrective action, either with its own materials and employees or by retaining any third party to do so, and deduct the cost and expense of such corrective action from the Contractor's compensation.

7. **Partial Utilization of Construction Project:** City shall have the right to use or occupy any portion of the Construction Project that City and Contractor mutually agree is substantially completed and constitutes a separately functioning and usable part of the Construction Project for its intended purpose without significant interference with Contractor's performance of the remaining portions of the Construction Project. In the event City takes possession of any portion of the Construction Project, such possession shall not be deemed an acceptance of the Construction Project, in whole or in part. Contractor shall still be required to conduct any final testing of the portions in the possession of the City. City's use of any portion of the Construction Project shall not be grounds for extensions of any construction deadlines or a change in the Contractor's compensation. Contractor's warranties shall run from the completion of the total Construction Project and not from the date the City may take possession of selected portions of the Construction Project.

8. **Related Work at the Site:** Nothing in this Agreement shall prevent or preclude City, through its own employees or by contract with any third party, from performing other work related to the Construction Project at the construction site; provided such related work is not otherwise addressed in this Agreement and provided such related work does not otherwise interfere with Contractor's performance of this Agreement or the completion of the Construction Project. Contractor shall afford any City employee, agent or representative, or any third party under contract with the City to perform the related work, proper and safe access to the construction site, a reasonable opportunity for the introduction and storage of materials and equipment, the opportunity to perform the related work, and shall properly coordinate the Contractor's work on the Construction Project with the related work.

9. **Contractor's Warranties:** Contractor represents and warrants as follows:

a. Unless otherwise specified by the terms of this Agreement, all materials and equipment used by Contractor on the Construction Project shall be new and where not otherwise specified, of the most suitable grade for their intended uses.

b. All workmanship and materials shall be of a kind and nature acceptable to the City.

c. All equipment, materials, and labor provided to, on, or for the Construction Project must be free of defects and nonconformities in design, materials, and workmanship for a minimum period beginning with the commencement of the work on the Construction Project and ending one (1) year from the final completion and acceptance by the City of the Construction Project, regardless of whether such equipment, materials, or labor were supplied directly by Contractor or indirectly by Contractor's subcontractors or suppliers. Other express warranties on materials that provide for a warranty period longer than one year apply for the period of that express warranty and are not reduced by this provision. Upon receipt of City's written notice of a defective or nonconforming condition during the warranty period, Contractor shall take all actions, including redesign and replacement, to correct the defective or nonconforming condition within a time frame acceptable to the City and at no additional

cost to the City. Contractor shall also, at its sole cost, perform any tests required by City to verify that such defective or nonconforming condition has been corrected. Contractor warrants the corrective action taken against defective and nonconforming conditions for a period of an additional one (1) year from the date of City's acceptance of the corrective action.

d. Contractor and its sureties are liable for the satisfaction and full performance of all warranties.

e. Contractor shall give its personal attention to the faithful prosecution of the completion of the Construction Project and Contractor, or its duly authorized representative assigned to serve as the Construction Project Manager, shall be personally present at the site of the Construction Project during working hours for the term of this Agreement until the completion of the Construction Project.

f. Contractor shall maintain an office at the site of the Construction Project and shall have a complete, accurate, and up-to-date set of construction plans, drawings, and specifications at that office at all times.

g. Contractor has examined all available records and made field examinations of the site of the Construction Project. Contractor has knowledge of the field conditions to be encountered during the Construction Project. Contractor has knowledge of the types and character of equipment necessary for the work, the types of materials needed and the sources of such materials, and the condition of the local labor market.

h. Contractor is responsible for the safety of the work and shall maintain all lights, guards, signs, temporary passages, or other protections necessary for that purpose at all times.

i. All work must be performed at Contractor's risk, and Contractor shall promptly repair or replace all damage and loss at its sole cost and expense regardless of the reason or cause of the damage or loss; provided, however, should the damage or loss be caused by an intentional or negligent act of the City, the risk of such loss shall be placed on the City.

j. Contractor is responsible for any loss or damage to materials, tools, or other articles used or held for use in the completion of performance of the Construction Project.

k. Contractor's performance must be without damage or disruption to any other work or property of the City or of others and without interference with the operation of existing machinery or equipment.

l. Title to all work, materials, and equipment covered by any payment of Contractor's compensation by City, whether directly incorporated into the Construction Project or not, passes to City at the time of payment, free and clear of all liens and encumbrances.

10. Delays and Extensions of Time: If Contractor's performance of this Agreement is prevented or delayed by any unforeseen cause beyond the control of the Contractor, including acts or omissions of the City, Contractor shall, within ten (10) days of the commencement of any such delay, give the City written notice thereof. Further, Contractor shall, within ten (10) days of the termination of such delay, give the City written notice of the total actual duration of the delay. If the City is provided with these required notices and if the City determines that the cause of the delay was not foreseeable, was beyond the control of the Contractor, and was not a result of the fault or negligence of the Contractor, then the City will determine the total duration of the delay and extend the time for performance of the Agreement accordingly. Unless the delay is caused by the intentional interference of the City with the Contractor's performance, Contractor shall make no claim for damages or any other claim other than for an extension of time as herein provided by reason of any delays.

11. Suspension:

a. The City may, by written notice to the Contractor and at its convenience for any reason, suspend the performance of all or any portion of the work to be performed on the Construction Project ("Notice of Suspension"). The Notice of Suspension shall set forth the time of suspension, if then known to the City. During the period of suspension, Contractor shall use its best efforts to minimize costs associated with the suspension.

b. Upon Contractor's receipt of any Notice of Suspension, unless the notice requires otherwise, Contractor shall: (1) immediately discontinue work on the date and to the extent specified in the Notice of Suspension; (2) place no further orders or subcontracts for materials, services, or equipment; (3) promptly make every reasonable effort to obtain suspension upon terms satisfactory to City of all orders, subcontracts, and rental agreements to the extent that they relate to the performance of the work suspended; and (4) continue to protect and maintain the Project, including those portions on which work has been suspended.

c. As compensation for the suspended work, Contractor will be reimbursed for the following costs, reasonably incurred, without duplication of any item, and to the extent that such costs directly resulted from the suspension: (1) a standby charge paid during the period of suspension which will be sufficient to compensate Contractor for keeping, to the extent required in the Notice of Suspension, Contractor's organization and equipment committed to the Project in standby status; (2) all reasonably incurred costs for the demobilization of Contractor's and subcontractor's crews and equipment; (3) an equitable amount to reimburse Contractor for the cost to protect and maintain the Project during the period of suspension; and (4) an equitable adjustment in the cost of performing the remaining portion of the work post-suspension if, as a direct result of the suspension, the cost to Contractor of subsequently performing the remaining work on the Construction Project has increased or decreased.

d. Upon receipt of written notice by the City to resume the suspended work ("Notice to Resume Work"), Contractor shall immediately resume performance of the suspended work as to the extent required in the Notice to Resume Work. Any claim by Contractor for time or compensation described in Section 11(c) shall be made within fifteen (15) days after receipt of the Notice to Resume Work and Contractor shall submit

a revised Construction Schedule for the City's review and approval. Contractor's failure to timely make such a claim shall result in a waiver of the claim.

e. No compensation described in Section 11(c) shall be paid and no extension of time to complete the Construction Project shall be granted if the suspension results from Contractor's non-compliance with or breach of the terms or requirements of this Agreement.

12. Termination for Contractor's Fault:

a. If Contractor refuses or fails to timely do the work, or any part thereof, or fails to perform any of its obligations under this Agreement, or otherwise breaches any terms or conditions of this Agreement, the City may, by written notice, terminate this Agreement and the Contractor's right to proceed with all or any part of the Construction Project ("Termination Notice Due to Contractor's Fault"). The City may then take over the Construction Project and complete it, either with its own resources or by re-letting the contract to any other third party, and may immediately take possession of and use such materials, appliances, tools, and equipment as may be on the site and which may be necessary for the completion of the Construction Project.

b. In the event of a termination pursuant to this Section 12, Contractor shall be entitled to payment only for those services Contractor actually rendered. In the case of a lump sum or unit price contract, Contractor shall not be entitled to any further payment until the Construction Project has been completed. Upon completion of the Construction Project, if the unpaid balance of the Contractor's compensation exceeds the cost to the City of completing the work, including all costs paid to any subcontractors or third parties retained by the City to complete the Construction Project and all administrative costs resulting from the termination ("City's Cost for Completion"), such excess shall be paid to the Contractor. If the City's Cost for Completion exceeds the unpaid balance of the Contractor's compensation, then Contractor and its sureties shall be liable for and shall pay the difference, plus interest at the rate applicable to court judgments, to the City.

c. Any termination provided for by this Section 12 shall be in addition to any other remedies to which the City may be entitled under the law or at equity.

d. In the event of termination under this Section 12, Contractor shall, under no circumstances, be entitled to claim or recover consequential, special, punitive, lost business opportunity, lost productivity, field office overhead, general conditions costs, or lost profits damages of any nature arising, or claimed to have arisen, as a result of the termination.

13. Termination for City's Convenience:

a. Should conditions arise which, in the sole opinion and discretion of the City, make it advisable to the City to cease work on the Construction Project, City may terminate this Agreement by written notice to Contractor ("Notice of Termination for City's Convenience"). The termination shall be effective in the manner specified in the Notice of Termination for City's Convenience and shall be without prejudice to any claims that the City may otherwise have against Contractor.

b. Upon receipt of the Notice of Termination for City's Convenience, unless otherwise directed in the Notice, the Contractor shall immediately cease work on the Construction Project, discontinue placing orders for materials, supplies, and equipment for the Construction Project, and make every reasonable effort to cancel all existing orders or contracts upon terms satisfactory to the City. Contractor shall do only such work as may be necessary to preserve, protect, and maintain work already completed, in progress, or in transit to the construction site.

c. In the event of a termination pursuant to this Section 13, Contractor is entitled to payment only for those services Contractor actually rendered and materials actually purchased or which Contractor has made obligations to purchase on or before the receipt of the Notice of Termination for City's Convenience, and reasonably incurred costs for demobilization of Contractor's and any subcontractor's crews. It is agreed that any materials that City is obligated to purchase from Contractor will remain the City's sole property.

d. The compensation described in Section 13(c) is the sole compensation due to Contractor for its performance of this Agreement. Contractor shall, under no circumstances, be entitled to claim or recover consequential, special, punitive, lost business opportunity, lost productivity, field office overhead, general conditions costs, or lost profits damages of any nature arising, or claimed to have arisen, as a result of the termination.

14. Limitation on Contractor's Damages; Time for Asserting Claim:

a. In the event of a claim for damages by Contractor under this Agreement, Contractor's damages shall be limited to contract damages and Contractor hereby expressly waives any right to claim or recover consequential, special, punitive, lost business opportunity, lost productivity, field office overhead, general conditions costs, or lost profits damages of any nature or kind.

b. In the event Contractor wants to assert a claim for damages of any kind or nature, Contractor shall provide City with written notice of its claim, the facts and circumstances surrounding and giving rise to the claim, and the total amount of damages sought by the claim, within ten (10) days of the facts and circumstances giving rise to the claim. In the event Contractor fails to provide such notice, Contractor shall waive all rights to assert such claim.

15. Representatives:

a. City's Representative: The City's Representative for the purpose of this Agreement shall be Gery Carpenter or such other individual as City shall designate in writing. Whenever approval or authorization from or communication or submission to City is required by this Agreement, such communication or submission shall be directed to City's Representative and approvals or authorizations shall be issued only by such Representative; provided, however, that in exigent circumstances when City's Representative is not available, Contractor may direct its communication or submission

to other designated City personnel or agents and may receive approvals or authorization from such persons.

b. Contractor's Representative: The Contractor's Representative for the purpose of this Agreement shall be _____ or such other individual as Contractor shall designate in writing. Whenever direction to or communication with Contractor is required by this Agreement, such direction or communication shall be directed to Contractor's Representative; provided, however, that in exigent circumstances when Contractor's Representative is not available, City may direct its direction or communication to other designated Contractor personnel or agents.

16. Locating Underground Facilities: Contractor shall be responsible for obtaining and determining the location of any underground facilities, including but not limited to, the location of any pipelines or utility supply, delivery, or service lines in accordance with the provisions of §69-4-501, et seq., MCA. Contractor shall make every effort to avoid damage to underground facilities and shall be solely responsible for any damage that may occur. If City personnel assume responsibility for locating any underground facilities, this fact shall be noted in writing prior to commencement of such location work.

17. Permits: Contractor shall provide all notices, comply with all applicable laws, ordinances, rules, and regulations, obtain all necessary permits, licenses, and inspections from applicable governmental authorities, pay all fees and charges in connection therewith, and perform all surveys and locations necessary for the timely completion of the Construction Project.

18. Ownership of Documents; Indemnification: All plans, designs, drawings, specifications, documents, sample results and data, in whatever medium or format, originated or prepared by or for Contractor in contemplation of, or in the course of, or as a result of this Agreement or work on the Construction Project, shall be promptly furnished to the City ("City Documents and Information"). All City Documents and Information shall be the exclusive property of the City and shall be deemed to be works-for-hire. Contractor hereby assigns all right, title, and interest in and to the City Documents and Information, including but not limited to, all copyright and patent rights in and to the City Documents and Information. Neither party grants to the other any express or implied licenses under any patents, copyrights, trademarks, or other intellectual property rights, except to the extent necessary to complete its obligations to the other under this Agreement.

19. Laws and Regulations: Contractor shall comply fully with all applicable state and federal laws, regulations, and municipal ordinances including, but not limited to, all workers' compensation laws, all environmental laws including, but not limited to, the generation and disposal of hazardous waste, the Occupational Safety and Health Act (OSHA), the safety rules, codes, and provisions of the Montana Safety Act in Title 50, Chapter 71, MCA, all applicable City, County, and State building and electrical codes, the Americans with Disabilities Act, and all non-discrimination, affirmative action, and utilization of minority and small business statutes and regulations.

20. Non-discrimination in Hiring: All hiring by Contractor and subcontractors of persons performing work for Contractor will be on the basis of merit and qualification and will not discriminate on the basis of race, color, religion, creed, political ideas, sex, age, marital status, physical or mental disability, or national origin.

21. Intoxicants; DOT Drug and Alcohol Regulations: Contractor shall not permit or suffer the introduction or use of any intoxicants, including alcohol or illegal drugs, upon the site of the Construction Project. Contractor acknowledges it is aware of and shall comply with its responsibilities and obligations under the U.S. Department of Transportation (DOT) regulations governing anti-drug and alcohol misuse prevention plans and related testing. City shall have the right to request proof of such compliance and Contractor shall be obligated to furnish such proof.

22. Labor Relations:

a. Contractor shall post a legible statement of all wages and fringe benefits to be paid to the Contractor's employees and the frequency of such payments (i.e., hourly wage employees shall be paid weekly). Such posting shall be made in a prominent and accessible location at the site of the Construction Project and shall be made no later than the first day of work. Such posting shall be removed only upon the final completion of the Construction Project and the termination of this Agreement.

b. In performing the terms and conditions of this Agreement and the work on the Construction Project, Contractor shall give preference to the employment of bona fide residents of Montana, as required by §18-2-403, MCA, and as such, term is defined by §18-2-401(1), MCA. When making assignments of work, Contractor shall use workers both skilled in their trade and specialized in their field of work for all work to which they are assigned.

c. Pursuant to §§18-2-403 and 18-2-422, MCA, Contractor shall pay wages, benefits, and expenses as set forth on Exhibit F, Contractor's Rates of Wages, Benefits, and Expenses, attached hereto. Contractor shall pay all hourly wage employees on a weekly basis. Violation of the requirements set forth on Exhibit F may subject the Contractor to the penalties set forth in §18-2-407, MCA. Contractor shall maintain payroll records and provide certified copies to the City. Contractor shall maintain such payroll records during the term of this Agreement, the course of the work on the Construction Project, and for a period of three (3) years following the date of final completion of the Construction Project and termination of this Agreement.

d. In the event that, during the term of this Agreement and throughout the course of Contractor's performance of the Construction Project, any labor problems or disputes of any type arise or materialize which in turn cause any work on the Construction Project to cease for any period of time, Contractor specifically agrees to take immediate steps, at its own expense and without expectation of reimbursement from City, to alleviate or resolve all such labor problems or disputes. The specific steps Contractor shall take to resume work on the Construction Project shall be left to the discretion of Contractor; provided, however, that Contractor shall bear all costs of any related legal action. Contractor shall provide immediate relief to the City so as to permit

the work on the Construction Project to resume and be completed within the time frames set forth in the Construction Schedule at no additional cost to City.

e. Contractor shall indemnify, defend, and hold the City harmless from any and all claims, demands, costs, expenses, damages, and liabilities arising out of, resulting from, or occurring in connection with any labor problems or disputes or any delays or stoppages of work associated with such problems or disputes.

23. Subcontractors:

a. Contractor may employ subcontractors for any work on the Construction Project only upon consent of the City. Contractor shall provide City with a list of all subcontractors employed.

b. Even with the City's consent to a subcontractor, Contractor remains fully responsible for the acts and omissions of any subcontractor, just as Contractor is for its own acts and omissions, and Contractor shall remain fully responsible and liable for the timely completion of the Construction Project.

c. Contractor is solely liable for any and all payments to subcontractors. Contractor shall hold all payments received from the City in trust for the benefit of subcontractors, and all such payments shall be used to satisfy obligations of the Construction Project before being used for any other purpose. Contractor shall make any payments due to any subcontractor within seven (7) days of Contractor's receipt of payment from the City. In the event of a dispute regarding any subcontractor's invoice, Contractor shall promptly pay the undisputed amount to the subcontractor and notify the subcontractor in writing of the amount in dispute and the reasons for the dispute. Any withholding of payment must comply with the requirements of §28-2-2103, MCA. In the event Contractor is unwilling or unable to make timely and proper payment to any subcontractor, City may elect to withhold any payment otherwise due to Contractor and upon seven (7) days' written notice to Contractor, may pay subcontractor by direct or joint payment.

24. Indebtedness and Liens: Before City may make any final payment to Contractor, Contractor shall furnish City with satisfactory proof that there are no outstanding debts or liens in connection with the Construction Project. If the Contractor allows any indebtedness to accrue to subcontractors or others during the progress of the work, and fails to pay or discharge the same within five (5) days after demand, then City may either withhold any money due to Contractor until such indebtedness is paid or apply the same towards the discharge of the indebtedness. If any lien or claim is filed or made by any subcontractor, material supplier, or any other person, the Contractor shall immediately notify the City and shall cause the same to be discharged of record within thirty (30) days after its filing.

25. Hazard Communication: Contractor shall comply with all hazard communication requirements dictated by the Environmental Protection Agency, the Montana Department of Agriculture, OSHA, Hazard Communications Standard, 29 CFR 1910.1200, and applicable City ordinances. Contractor shall supply a chemical list, the associated material safety data sheets (MSDS), and other pertinent health exposure data for chemicals that the Contractor's, subcontractor's or the City's employees may be exposed to while working on City

property during the course of the Construction Project. One copy of this documentation must be delivered to City to the attention of the City's Representative. This documentation must be delivered before work involving these chemicals may commence.

26. Accounts and Records: During the term of this Agreement and for three (3) years following the City's final acceptance of the Construction Project, Contractor shall maintain accounts and records related to the Construction Project. Upon reasonable notice, City shall have the right to inspect all such accounts and records, including but not limited to, Contractor's records, books, correspondence, instructions, drawings, specifications, field and site notes, receipts, invoices, bills, contracts, or other documents relating to the Construction Project.

27. Indemnification; Insurance; Bonds:

a. To the fullest extent permitted by law, Contractor shall fully indemnify, defend, and save City, its agents, representatives, employees, and officers harmless from and against any and all claims, actions, costs, fees, losses, liabilities or damages of whatever kind or nature arising from or related to Contractor's performance of this Agreement and Contractor's work on the Construction Project or work of any subcontractor or supplier to Contractor.

b. Contractor shall maintain those insurances as may be required by City as set forth on the attached Exhibit G, Required Insurance Coverage, and Contractor shall provide City with proof of such insurance coverage within ten (10) days following execution of this Agreement and at least annually thereafter during the term of the Project. Contractor shall notify City thirty (30) days prior to the expiration of any such required insurance coverage and shall ensure such required insurance coverage is timely renewed during the term of this Agreement so that there is no lapse in coverage during Contractor's performance of this Agreement. Contractor shall further notify City within two (2) business days of Contractor's receipt of notice that any required insurance coverage will be terminated or Contractor's decision to terminate any required insurance coverage for any reason. Each required insurance coverage must name the City and the architect and engineer as additional insureds.

c. Contractor shall maintain those security guarantees set forth on the attached **Exhibit H**, Required Bonds.

28. Taxes: Contractor is obligated to pay all taxes of any kind or nature and make all appropriate employee withholdings. Contractor understands that all contractors or subcontractors working on a publicly funded project are required to pay or have withheld from earnings a license fee of one percent (1%) of the gross contract price if the gross contract price is Five Thousand Dollars ($5,000) or more. This license fee is paid to the Montana Department of Revenue.

29. Dispute Resolution:

a. Any claim, controversy, or dispute between the parties, their agents, employees, or representatives shall be resolved first by negotiation between senior-level personnel from each party duly authorized to execute settlement agreements. Upon

mutual agreement of the parties, the parties may invite an independent, disinterested mediator to assist in the negotiated settlement discussions.

b. If the parties are unable to resolve the dispute within thirty (30) days from the date the dispute was first raised, then such dispute shall be resolved in a court of competent jurisdiction in compliance with the Applicable Law provisions of this Agreement.

30. Survival: Contractor's indemnification and warranty obligations shall survive the termination or expiration of this Agreement for the maximum period allowed under applicable law.

31. Headings: The headings used in this Agreement are for convenience only and are not be construed as a part of the Agreement or as a limitation on the scope of the particular paragraphs to which they refer.

32. Waiver: A waiver by City of any default or breach by Contractor of any covenants, terms, or conditions of this Agreement does not limit City's right to enforce such covenants, terms, or conditions or to pursue City's rights in the event of any subsequent default or breach.

33. Severability: If any portion of this Agreement is held to be void or unenforceable, the balance thereof shall continue in effect.

34. Applicable Law: The parties agree that this Agreement is governed in all respects by the laws of the State of Montana and the parties expressly agree that venue will be in Lewis and Clark County, Montana, and no other venue.

35. Binding Effect: This Agreement is binding upon and inures to the benefit of the heirs, legal representatives, successors, and assigns of the parties.

36. Amendments: This Agreement may not be modified, amended, or changed in any respect except by a written document signed by all parties.

37. No Third-Party Beneficiary: This Agreement is for the exclusive benefit of the parties, does not constitute a third-party beneficiary agreement, and may not be relied upon or enforced by a third party.

38. Counterparts: This Agreement may be executed in counterparts, which together constitute one instrument.

39. Assignment: Contractor may not assign this Agreement in whole or in part without the prior written consent of the City. No assignment will relieve Contractor of its responsibility for the performance of the Agreement and the completion of the Construction Project. Contractor may not assign to any third party other than Contractor's subcontractors on the Construction Project, the right to receive monies due from City without the prior written consent of City.

40. **Authority:** Each party represents that it has full power and authority to enter into and perform this Agreement and the person signing this Agreement on behalf of each party has been properly authorized and empowered to sign this Agreement.

41. **Independent Contractor:** The parties agree and acknowledge that in the performance of this Agreement and the completion of the Construction Project, Contractor shall render services as an independent contractor and not as the agent, representative, subcontractor, or employee of the City. The parties further agree that all individuals and companies retained by Contractor at all times will be considered the agents, employees, or independent contractors of Contractor and at no time will they be the employees, agents, or representatives of the City.

42. **Agreement Documents:** All work on the Construction Project shall be performed by Contractor in accordance with all of the terms and conditions of this Agreement and all Exhibits attached hereto, which Exhibits consist of the following documents and are incorporated herein by this reference:

Exhibit A: Bid Form
Exhibit B: City Supplied Materials
Exhibit C: Construction Schedule
Exhibit D: Compensation Schedule
Exhibit E: Change of Work Specifications
Exhibit F: Contractor's Rates of Wages, Benefits, and Expenses
Exhibit G: Required Insurance Coverage
Exhibit H: Required Bonds

43. **Integration:** This Agreement and all Exhibits attached hereto constitute the entire agreement of the parties. Covenants or representations not contained therein or made a part thereof by reference, are not binding upon the parties. There are no understandings between the parties other than as set forth in this Agreement. All communications, either verbal or written, made prior to the date of this Agreement are hereby abrogated and withdrawn unless specifically made a part of this Agreement by reference.

IN WITNESS WHEREOF, Contractor and City have caused this Agreement to be executed, effective on the date written above, and intend to be legally bound thereby.

CITY OF HELENA, MONTANA

By: _____
Ronald J. Alles, City Manager

_____**, CONTRACTOR**

By: _____

Print Name: _____

Title: _____

APPROVED AS TO FORM (§18-2-406, MCA):

By: _____
David L. Nielsen, City Attorney

Exhibit A

BID FORM

PROJECT:

Centennial Park Project

City Project No. PR8914

THIS BID SUBMITTED TO:

Honorable Mayor and City Commission

City of Helena
316 North Park Avenue
Helena, Montana 59623

1. **THE UNDERSIGNED BIDDER** proposes and agrees that if this bid is accepted, Bidder will enter into the Agreement with the City in the form included in the bidding documents and to perform and furnish all work as specified or indicated in the bidding documents for the prices and within the number of calendar days indicated in the Agreement and in accordance with the other terms and conditions of the bidding documents.

2. Bidder has examined, understands, accepts, and abides by all of the terms and conditions of the Request For Bid and Instructions to Bidders.

3. Bidder expressly covenants that if Bidder is awarded the contract, Bidder will, after the bid is awarded and within the time specified in the Request For Bid, enter into a formal contract and give an approved performance bond and a labor and materials payment bond to secure the performance of the terms and conditions of the contract. The bid must be accompanied by Bid Security payable to the *City of Helena* for ten percent (10%) of the total amount of the bid, including alternates, if any. The Bid Security must be in a form specified in §18-1-203, MCA, which includes, but is not limited to, certified check, cashier's check, bank draft, bid bond, guaranty bond, or surety bond. The Bid Security is attached hereto as **Exhibit 1**.

4. This bid will remain subject to acceptance for sixty (60) days after the bid opening, or for such longer period of time that Bidder may agree to in writing upon request of City.

5. Bidder further represents that this bid is genuine and not made in the interest of or on behalf of any undisclosed individual or entity and is not submitted in conformity with any agreement or rules of any group, association, organization, or corporation; Bidder has not solicited or induced any person, firm, or corporation to refrain from bidding; and Bidder has not sought by collusion to obtain for itself any advantage over any other bidder or over City.

6. Bidder certifies that no official of the City, no consulting engineer or architect, or any member of such official's or consulting engineer's or architect's immediate family has direct or indirect interest in the pecuniary profits or contracts of the Bidder.

7. Bidder will complete the work in accordance with the Contract Documents for the price stated on the Bid Sheet attached hereto as **Exhibit 2**, based upon unit prices for estimated quantities. The Bidder will provide each unit price, which must be expressly stated on the Bid Sheet so it does not have to be calculated by the City by dividing the total of the unit prices by the number of estimated quantities.

8. Bidder acknowledges that estimated quantities set forth on the Bid Sheet are not guaranteed and are provided solely for the purpose of comparison of bids. The actual amount of work done and materials furnished may differ from such estimated quantities and the basis for final payment for all unit price bid items is the actual quantities provided per City's request. The successful bidder may not make a claim for anticipated profits or other damages on account of any difference between the amounts of work and material actually provided and the estimated amounts used on the Bid Sheet.

9. Bidder understands that the unit prices shall govern in checking the bid, and should a discrepancy exist in the total estimated price and total amount of unit prices bid as listed on the Bid Sheet after extensions are checked and corrections made, if any, the total amount of unit prices bid as corrected shall be used in awarding the contract.

10. Bidder certifies that Bidder is a responsible bidder and has the required qualifications and experience as submitted by Bidder on the Qualifications attached hereto as **Exhibit 3**.

11. Bidder agrees that the work will be substantially completed and ready for final payment in accordance with the Agreement on or before the dates or within the number of calendar days indicated in the Agreement.

12. Bidder accepts the provisions of the Agreement as to liquidated damages in the event of failure to complete the work within the times specified above, which shall be stated in the Agreement.

13. Bidder certifies receipt of City's revisions or additions made subsequent to the advertised proposal, which are specifically acknowledged on Receipt of Addendum, attached hereto as Exhibit 4.

14. Bidder represents that the bid is genuine and not collusive or a sham and that bidder has not colluded, conspired, connived, or agreed, directly or indirectly, with any bidder or person, to put in a sham bid or to refrain from bidding. Bidder further represents that Bidder has not sought by agreement or collusion, directly or indirectly, with any person, to fix the bid price of any other bidder, or to fix any overhead, profit, or cost element of said bid price or that of any other bidder, or to secure any advantage against the City or any person interested in the proposed bid. Bidder affirms that all statements in this bid are true.

SUBMITTED on _____

Montana Contractor's Registration # _____

Employer's Tax ID # _____

IF BIDDER is:

An Individual: _____
(Name typed or printed)

By: _____
_____(SEAL)
(Individual's Signature)

Doing business as: _____

Business Address: _____

Telephone # _____ FAX # _____

A Partnership: _____
(Partnership Name)

By: _____
_____(SEAL)
(Signature)

_____
(Name typed or printed)

Business Address: _____

Telephone # _____ FAX # _____

A Corporation: _____
_____(SEAL)
(Corporation Name)

State of Incorporation: _____

Type (General Business, Professional, Service, Limited Liability): _____

By: _____
(Signature of Authorized Representative)

Print Name and Title: _____

Attest: _____(Corporate Seal)
(Signature of Secretary)

Business Address: _____

Telephone # _____ FAX # _____

Date of Qualification To Do Business Is: _____

A Joint Venture: Each Joint Venture Must Sign

Joint Venture Name: _____
_____(SEAL)
(Name)

By: _____
(Signature of Joint Venture Partner)

Name: _____
(Name, printed or typed)

Title: _____

Business Address: _____

Telephone # _____ FAX # _____

A Joint Venture: Each Joint Venture Must Sign

Joint Venture Name: _____
_____(SEAL)

(Name)

By: _____

(Signature of Joint Venture Partner)

Name: _____

(Name, printed or typed)

Title: _____

Business Address: _____

Telephone # _____ FAX # _____

Address of Joint Venture for Receipt of Official Communication:

Address: _____

Telephone # _____ FAX # _____

(Each Joint Venture must sign. The manner of signing for each individual, partnership and corporation that is a party to the joint venture should be in the manner indicated above.)

Exhibit 1

Bid Security

Attached.

Exhibit 2

BID SHEET

BASE BID

ITEM	ESTIMATED QTY	UNIT	ITEM DESCRIPTION	UNIT COST	TOTAL COST
1	1	LS	MOBILIZATION		
2	1	LS	SITE CLEARING/DEMOLITION		
3	14	ACRE	HERBICIDE APPLICATION AND DISKING		
4	13,100	CY	SITE GRADING		
5	110,771	CY	PROVIDE AND PLACE IMPORTED FILL		
6	19,814	CY	PROVIDE AND PLACE TOPSOIL		
7	1	LS	CONSTRUCT POND		
8	4	EA	ADJUST MONITORING WELL ELEVATIONS		
9	20	EA	ADJUST MANHOLES AND VAULTS		
10	2	EA	STORM DROP INLET WITH GRATE		
11	194	FT	10" HDPE STORM PIPE		
12	1	EA	48" DIA. STORM SEWER MANHOLE		
13	615	LF	2" WATER SERVICE PIPING		
14	1,540	LF	1 1/2" WATER SERVICE PIPING		
15	1	EA	WATER BLOW-OUT VAULT		
16	1	EA	WATER SERVICE CONNECTION		
17	830	LF	1 1/2" PRESSURE SEWER SERVICE		
18	920	LF	1" PRESSURE SEWER SERVICE		
19	1	LS	6" FIRE HYDRANT w/ GATE VALVE		
20	2,465	LF	TYPE 1 DRAINAGE DITCH		
21	502	LF	TYPE 2 DRAINAGE DITCH		
22	45	LF	12" HDPE CULVERT		
23	282	LF	18" HDPE CULVERT		
24	1	EA	6" WATER SERVICE CONNECTION		
25	1	EA	WATER METER/PRV PIT		
26	100,000	SF	ASPHALT PAVEMENT		
27	2,600	LF	CURB AND GUTTER		
28	60,000	SF	LOOP ROAD/PARKING AREA SURFACING		
29	27,700	SF	FIRE ACCESS ROAD AND CENTRAL FIELD AREA SURFACING		
30	2	EA	CONCRETE PEDESTRIAN CROSSING		
31	8,374	LF	ASPHALT TRAIL		
32	3,953	LF	DG TRAIL		
33	6	EA	REMOVABLE BOLLARDS		
34	4	EA	STANDARD BOLLARDS		
35	19	EA	SIGNS		
36	1,500	TON	EXCAVATED WASTE REMOVAL/DISPOSAL		
37	200	CY	SELECT FILL		
38	800	CY	3/4 MINUS FILL		
39	1,000	SY	GCL		
40	24	HR	EXPLORATORY EXCAVATION		
41	1	LS	ELECTRICAL		

42	4	EA	SOFTBALL INFIELD CONSTRUCTION		
43	3	EA	SOFTBALL WARNING TRACK CONSTRUCTION		
44	1295	LF	CHAIN LINK FENCING		
45	1,161,205	SF	DRILL SEEDED TURF		
46	25,230	SF	SOD		
47	295,250	SF	DRYLAND SEEDING		
48	16,506	SF	DRYLAND SEEDING AT STEEP SLOPES		
49	140	LF	LANDSCAPE EDGING		
50	20	EA	PREPARATION FOR TREE PLANTING AT PARKING LOT ISLANDS (DOUBLE STALLS)		
51	5	EA	PREPARATION FOR TREE PLANTING AT PARKING LOT ISLANDS (SINGLE STALLS)		
52	1655	SF	ROCK MULCH INFILL		
53	39	EA	ORNAMENTAL TREE PLANTING		
54	119	EA	SHADE TREE PLANTING		
55	24	EA	EVERGREEN TREE PLANTING		
56	1	LS	IRRIGATION SYSTEM		
				TOTAL BASE BID	

(Total Base Bid Price Written in Words)

The above price includes completion of all the work called for under this Contract. The scope of work shall include all work specified herein and shown on the plans. All of the work shall be complete by the dates set forth in the Agreement.

It is the Contractor's obligation to have thoroughly familiarized himself/herself with the site, the conditions under which the work will be done, and the actual quantities required to complete the work in accordance with the intent of the plans and specifications and that the above stated price, as bid, covers the complete work as required.

The following alternate prices may be used to adjust the contract sum in the event the Owner desires to increase the scope of the project. The Contractor understands the Owner reserves the right to select any, all or none of the alternative prices, and to adjust the contract amount accordingly. Alternates may be selected in any order or combination. All alternative prices shall be for all work required to furnish and install, including incidentals, complete-in-place systems.

ALTERNATE BID

ITEM	ESTIMATED QTY	UNIT	ITEM DESCRIPTION	UNIT COST	TOTAL COST
A1	1515	LF	HDPE WATER AND SEWER SERVICE LINES		
A2	1	LS	SOFTBALL INFIELD DRAINAGE		
A3	1	LS	FERTILIZER		
A4	1,180	LF	SPLIT RAIL FENCING		

A5	8,374	LF	PARALLEL DECOMPOSED GRANITE TRAIL		
A6	1	LS	ELECTRICAL CONDUIT		
A7	1	LS	ELECTRICAL SERVICE		
A8	1	LS	ELECTRICAL CONDUIT FOR LIGHTING		
A9	1	LS	ELECTRICAL CONDUIT FOR LIGHTING		
A10	1	LS	LIGHTING		
A11	1	LS	LIGHTING		

The following unit prices may be used to adjust the contract sum in the event the Owner desires to increase or decrease the scope of work. The Contractor understands the Owner reserves the right to select any, all or none of the unit prices, and to adjust the contract amount accordingly.

All unit prices shall be for all work required to furnish and install, including incidentals, complete-in-place systems. Unit price items may or may not be included in base bid work. No adjustment to base bid and alternative amounts shall be made without written authorization prior to commencement of the work.

UNIT PRICES

UNIT	ITEM DESCRIPTION	UNIT COST
SF	WEED BARRIER FABRIC	
CY	SHREDDED BARK MULCH	
LF	ALUMINUM LANDSCAPE EDGING	
LF	ROOT BARRIER AT PARKING LOT PLANTERS	
LF	COMPOSITE DRAIN AT PARKING LOT PLANTERS	
EA	SPRAY HEAD WITH BUBBLER NOZZLE	
EA	SPRAY HEAD WITH SPRAY NOZZLE	
EA	I-20 SERIES ROTOR	
EA	I-25 SERIES ROTOR	
EA	I-25 STAINLESS STEEL HIGH SPEED SERIES ROTOR	
EA	AIR RELIEF VALVE AS DETAILED	
EA	3" ISOLATION VALVE AS DETAILED	
EA	4" ISOLATION VALVE AS DETAILED	
EA	6" ISOLATION VALVE AS DETAILED	
EA	8" ISOLATION VALVE AS DETAILED	
EA	MAINLINE DRAIN VALVE AS DETAILED	
EA	QUICK COUPLING VALVE AS DETAILED	
EA	1" ELECTRIC CONTROL VALVE AS DETAILED	
EA	1-1/2" ELECTRIC CONTROL VALVE AS DETAILED	
EA	2" ELECTRIC CONTROL VALVE AS DETAILED	
EA	1" DRIP ZONE CONTROL KIT AS DETAILED	
EA	2" MASTER VALVE WITH 3" FLOW SENSOR AND GATE VALVE ASSEMBLY AS DETAILED.	
EA	POST MOUNTED ET SENSOR AS DETAILED	
EA	30 STATION PEDESTAL CONTROLLER WITH COMMUNICATION MODULES	
EA	36 STATION PEDESTAL CONTROLLER WITH COMMUNICATION MODULES	
EA	GROUNDING GRID AS DETAILED	
LF	8" CL 200 PVC MAINLINE PIPE	
LF	6" CL 200 PVC MAINLINE PIPE	
LF	4" CL 200 PVC MAINLINE PIPE	

Exhibit 2

LF	3" CL 200 PVC MAINLINE PIPE	
LF	3" CL 200 PVC LATERAL PIPE	
LF	2" CL 200 PVC LATERAL PIPE	
LF	1-1/2" CL 200 PVC LATERAL PIPE	
LF	1" CL 200 PVC LATERAL PIPE	
LF	10" SCH 40 PVC SLEEVE	
LF	8" SCH 40 PVC SLEEVE	
LF	6" SCH 40 PVC SLEEVE	
LF	4" SCH 40 PVC SLEEVE	
LF	3" SCH 40 PVC SLEEVE	
LS	4" BACKFLOW PREVENTER ASSEMBLY WITH ENCLOSURE AS DETAILED	
LF	GCBL CENTRAL CONTROL CABLE	
LF	#14 SIGNAL WIRE	
LF	#12 COMMON WIRE	
LS	DRIPPERLINE IRRIGATION AT ONE TREE	

Submitted by: _____

Contractor

_____

Signature

END OF BID FORM

Exhibit 3

Qualifications

QUALIFICATIONS OF IRRIGATION CONTRACTOR

The Owner requires that any sub-contractor proposing to do work on the irrigation system will be required to submit documentation and evidence of successful completion of irrigation construction experience similar in size and scope to include at a minimum the following:

- Name, address and telephone number of irrigation sub-contractor.
- List of all public contracts completed within the past three (3) years. Provide name, address and telephone number for all project owners. List the value of all contracts. State whether or not the project was completed within the contract time frame, and indicate whether or not liquidated damages were charged.
- List of equipment and manpower that will be assigned to the project, with consideration given to other contracts in-progress.
- Provide list of experience for all lead men or foremen to be assigned to the project.
- Certification that the Contractor is not currently working beyond the contract completion date on any public contract.
- Certification that the Contractor has completed a minimum of 3 irrigation systems of similar size and scope in the last five (5) years

Exhibit 4

Receipt Of Addendum

Bidder acknowledges receipt of the following addendum of revisions or additions:

Addendum Number	Date Issued	Authorized Signature For Each
1		
2		
3		
4		
5		

Exhibit B

City Supplied Materials

3,500 CY of fill material, project contractor will spread and compact.

Exhibit C

Construction Schedule

Exhibit D

Compensation Schedule

Contractor shall not demand or be entitled to receive payment for any work on the Construction Project, in whole or in part, except in the manner set forth herein.

Monthly Progress Payments

A. After the commencement of work on the Construction Project, the Contractor may request monthly progress payments by submitting an Application for Payment to the City during each successive calendar month, with a copy to the project architect or engineer. The Application for Payment must be based upon the actual or estimated percentage of work completed and materials supplied on the Construction Project prior to the date of the Application and shall be filled out and signed by the Contractor. Contractor shall attach all supporting documentation to the Application, including certified payroll records and receipts, to verify that the work claimed in the Application has been completed. Only one Application for Payment may be submitted within a calendar month.

B. Beginning with the second Application for Payment, each Application shall also include an affidavit signed by the Contractor stating that all previous monthly progress payments received have been applied on account to discharge Contractor's obligations associated with the prior Applications for Payment.

C. City and its architect or engineer shall promptly review all Applications for Payment and, within twenty-one (21) days after receipt of each Application, determine whether a progress payment should be disapproved in whole or in part. An Application for Payment is considered to have been received when it is submitted to City's Representative and is considered approved unless prior to the expiration of the 21-day period the City or its architect or engineer provides the Contractor with a written statement containing specific items that are being disapproved. A progress payment or any portion may be disapproved upon a claim of: **(1)** unsatisfactory job progress; **(2)** failure to remedy defective construction work or materials; **(3)** disputed work or materials; **(4)** failure to comply with material provisions of this Agreement, drawings, plans, specifications for the Construction Project, or other required documents, including but not limited to, payroll certifications, insurance coverage, bonding, lien releases, warranties, material certifications, and test data; **(5)** failure of Contractor to make timely payment for claims including, but not limited to claims for labor, equipment, materials, subcontracts, taxes, fees, professional services, rent, and royalties; **(6)** damages to the City; **(7)** the existence of reasonable evidence that the Agreement cannot be completed for the unpaid balance of the Agreement's Compensation; and **(8)** Contractor's non-compliance with applicable federal, state, and local laws, rules, and ordinances.

D. The City will furnish Contractor a written statement specifying a reason for disapproval that is listed in Section C above for which approval of the Application for Payment or a portion thereof is being withheld. If the City disapproves only a portion of an Application for Payment, the remainder of the Application for Payment is considered approved.

E. If the City approves a monthly progress payment, the City shall withhold the five percent (5%) Retainage Amount from the total payment requested in the Application for

Payment and may withhold an amount that is sufficient to pay the direct expenses that the City may reasonably expect will be necessary to correct any claim based on the eight (8) items set out in Section C above. City shall tender the balance of the approved monthly progress payment to Contractor within seven (7) days following the approval.

F. Contractor understands that the Montana Public Contractors' Gross Receipts Tax requires all contractors or subcontractors working on a publicly funded project to pay or have withheld from earnings one percent (1%) of the gross contract price if the public contract price, including subcontracts attached thereto, is Five Thousand Dollars ($5,000) or more. If required, the City will withhold this tax from any payment made to Contractor and will remit the amount withheld to the Montana Department of Revenue. Contractor must withhold the tax from payments made to subcontractors by Contractor.

G. City's approval of any progress payment shall not operate as City's acceptance of any portion of the Construction Project as complete or free of defects or nonconformities, nor shall it operate as a waiver of Contractor's obligations under the Agreement including, but not limited to, Contractor's testing and warranty obligations.

Final Payment

A. Upon completion of the Construction Project, Contractor shall submit an Application for Final Payment to the City, with a copy to the project architect or engineer, seeking payment of the remaining balance of Contractor's compensation, including all retainage amounts. Contractor shall attach all supporting documentation and receipts to the Application for Final Payment to verify that the Construction Project has been fully and finally completed in compliance with all terms and conditions of the Agreement, including complete and legally effective releases or waivers of all liens or encumbrances that have been filed against the Construction Project, and a consent from all of Contractor's sureties to final payment. In addition, Contractor shall include an affidavit signed by the Contractor stating that all previous monthly progress payments received have been applied on account to discharge Contractor's obligations associated with the Construction Project and that the prior Applications for Payment and all claims asserted by any person arising from or related to the Construction Project have been settled or satisfied. In the event any claims have not been settled or satisfied, the Affidavit shall contain a complete listing of such claims, the name and address of each person making a claim, the facts and circumstances surrounding each claim, the amount of each claim, and the efforts made to date by Contractor to resolve, settle or satisfy each claim.

B. City and its architect or engineer shall promptly review the Application for Final Payment and, within twenty-one (21) days after receipt of the request, determine whether it should be disapproved in whole or in part. An Application for Final Payment is considered to have been received when it is submitted to City's Representative and is considered approved unless the City or its architect or engineer provides the Contractor with a written statement containing specific items that are being disapproved prior to the expiration of the 21-day period. A final payment or any portion may be disapproved upon a claim of: **(1)** unsatisfactory job progress; **(2)** after City's final inspection of the Construction Project, Contractor has not completed all punch list items and failed to remedy defective construction work or materials; **(3)** disputed work or materials; **(4)** failure to comply with material provisions of this Agreement, drawings, plans, specifications for the Construction Project, or other required documents including, but not limited to, payroll certifications, insurance coverage, bonding, lien releases,

warranties, material certifications, and test data; **(5)** failure of Contractor to make timely payment for claims including, but not limited to, claims for labor, equipment, materials, subcontracts, taxes, fees, professional services, rent, and royalties; **(6)** claims have been brought or liens have been filed against Contractor or the City related to the Construction Project, or any such claims have not been properly documented in Contractor's Affidavit; **(7)** damage to the City; **(8)** Contractor has not delivered all maintenance and operating instructions, marked-up record documents, and any other documents relating to the Construction Project as required by City; and **(9)** the Contractor is not in compliance with applicable federal, state, and local laws, rules, and ordinances and has not remedied the noncompliance.

C. The City will furnish Contractor a written statement specifying a reason for disapproval that is listed in Section B above for which approval of the Application for Final Payment or a portion thereof is being withheld. If the City disapproves only a portion of an Application for Payment, the remainder of the Application for Payment is considered approved.

D. Final payment is due and payable within fourteen (14) days of City's approval, but City may withhold an amount that is sufficient to pay the direct expenses that the City may reasonably expect will be necessary to correct any claim based on the nine (9) items set out in Section B above and any tax withholding required by law.

Exhibit E

Change of Work Specifications

A. City may, at any time or from time to time, order changes, additions, deletions, or revisions to the work on the Construction Project by submitting a written Change Order to Contractor. Upon receipt of any Change Order, Contractor shall comply with the terms of the changed work as reflected in the Change Order.

B. City and Contractor shall negotiate in good faith for an agreement as to any increase or decrease in the Contractor's compensation that results from any Change Order. The increased or decreased Contractor's compensation shall be set forth in the Change Order and both the City and the Contractor shall sign the Change Order as an indication of their respective acceptance of the changes and modifications to the Agreement. In the event the City and Contractor are unable to agree upon the increase or decrease in Contractor's compensation resulting from any Change Order, such increase or decrease shall be determined as follows:

1. increases to Contractor's compensation shall be calculated as follows and shall be evidenced by Contractor's submission to the City of its actual supporting documentation including time slips/cards, invoices, and receipts:

a. by unit prices otherwise set forth in the Agreement or subsequently agreed upon;

b. by an agreed upon lump sum; or

c. by the cost of the work and an agreed upon mark-up for Contractor's overhead and profit, with the costs of the work determined as follows:

(i) Contractor's actual, direct payroll expenses for the cost of labor. Payroll expenses shall only include actual gross wages paid, without any deductions, withholding, or overhead. The agreed upon mark-up fee shall cover Contractor's liability insurance, workers' compensation, and Social Security taxes applicable to said wages, Contractor's reasonable profit, the costs for the use of small tools and equipment not otherwise classified under heavy equipment use, and Contractor's general overhead expenses.

(ii) Contractor's actual cost of materials, including actual transportation costs, for all materials supplied by Contractor.

(iii) Costs for the use of heavy equipment and the transportation of the same. Such costs shall be the actual rental fees incurred for the use of the heavy equipment and the actual costs of transporting such heavy equipment to and from the site of the Construction Project.

2. decreases to Contractor's compensation shall be determined by the City's good faith estimate. If Contractor disagrees with such good faith estimate, Contractor can avail itself of the Dispute Resolution provisions set forth in the Agreement.

C. Except for minor modifications in the work not involving an increase of costs or Contractor's compensation and not inconsistent with the purposes of the work required by the Agreement, and except in an emergency situation which endangers life or property, no change to the work requirements shall be made unless pursuant to a written Change Order duly executed.

D. Contractor shall not be entitled to any increase in the Contractor's compensation or the extension of any deadlines set forth in Construction Schedule with respect to any work performed by Contractor that is not required by the terms and conditions of the Agreement and is not contained in a duly executed Change Order.

Exhibit F

Contractor's Rates of Wages, Benefits, and Expenses

For purposes of prevailing wage requirements, this Project is considered as Heavy Construction. The Montana Prevailing Wage Rates for this type of project, as included in these Contract Documents, are incorporated herein by this reference.

1
MONTANA
PREVAILING WAGE RATES FOR
HEAVY CONSTRUCTION
2009
Rates Effective: May 15, 2009
Brian Schweitzer, Governor
State of Montana
Keith Kelly, Commissioner
Department of Labor & Industry
To obtain copies of prevailing wage rate schedules, or for information relating to public works projects and payment of prevailing
wage rates visit ERD at **www.mtwagehourbopa.com** or contact them at:
Employment Relations Division
Montana Department of Labor and Industry
P. O. Box 201503
Helena, MT 59620-1503
Phone 406-444-5600
TDD 406-444-5549
The Labor Standards Bureau welcomes questions, comments and suggestions from the public. In addition, we'll do our
best to provide information in accessible format, on request, in compliance with the Americans with Disabilities Act.
MONTANA PREVAILING WAGE REQUIREMENTS
The Commissioner of the Department of Labor and Industry, in accordance with Sections 18-2-401 and 18-2-402 of the Montana
Code Annotated, has determined the standard prevailing rate of wages for the occupations listed in this publication.
The wages specified herein control the prevailing rate of wages for the purposes of 18-2-401, et seq., Montana Code Annotated. It
is required that each employer pay, as a minimum, the rate of wages, including fringe benefits, travel allowance and per diem
applicable to the district in which the work is being performed, as provided in the attached wage determinations.
All Montana Prevailing Wage Rates are available on the Internet at **www.mtwagehourbopa.com** or by contacting the Labor
Standards Bureau at (406) 444-5600 or TDD (406) 444-5549.
In addition, this publication provides general information concerning compliance with Montana's Prevailing Wage Law and

payment of prevailing wages. For detailed compliance information relating to Public Works projects and payment of prevailing
wage rates, please consult the Regulations on the Internet at **www.mtwagehourbopa.com** or contact the Labor Standards
Bureau at (406) 444-5600 or TDD (406) 444-5549.
KEITH KELLY
Commissioner
Department of Labor and Industry
State of Montana
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A. Date of Publication: May 15, 2009

B. Definition of Heavy Construction

The Administrative Rules of Montana (ARM) 24.17.501 (4) – (4)(a), Public Works Contracts For Construction Services Subject to Prevailing
Rates, states: *"Heavy construction projects include, but are not limited to, those projects that are not properly classified as either 'building*
construction', or 'highway construction.'
Heavy construction projects include, but are not limited to, antenna towers, bridges (major bridges designed for commercial navigation),
breakwaters, caissons (other than building or highway), canals, channels, channel cut-offs, chemical complexes or facilities (other than
buildings), cofferdams, coke ovens, dams, demolition (not incidental to construction), dikes, docks, drainage projects, dredging projects,
electrification projects (outdoor), fish hatcheries, flood control projects, industrial incinerators (other than building), irrigation projects,
jetties, kilns, land drainage (not incidental to other construction), land leveling (not incidental to other construction), land reclamation, levees,
locks and waterways, oil refineries (other than buildings), pipe lines, ponds, pumping stations (prefabricated drop-in units – not buildings),
railroad construction, reservoirs, revetments, sewage collection and disposal lines, sewers (sanitary, storm, etc.), shoreline maintenance, ski
tows, storage tanks, swimming pools (outdoor), subways (other than buildings), tipples, tunnels, unsheltered piers and wharves, viaducts (other
than highway), water mains, waterway construction, water supply lines (not incidental to building), water and sewage treatment plants (other

than buildings) and wells."
Federal Davis-Bacon wage rates as published in U.S. Department of Labor General Wage Decision No. MT080001 Modification No.8 have
been adopted by the Montana Department of Labor and Industry for use in Heavy Construction projects and are included in this publication.
These rates apply statewide or as shown in MT080001 Modification No. 8.

C. Definition of Highway Construction

The Administrative Rules of Montana (ARM) 24.17.501 (3) – (3)(a), Public Works Contracts For Construction Services Subject to Prevailing
Rates, states: *"Highway construction projects include, but are not limited to, the construction, alteration, or repair of roads, streets, highways,*
runways, taxiways, alleys, trails, paths, and parking areas, bridges constructed or repaired in conjunction with highway work, and other
similar projects not incidental to building construction or heavy construction.
Highway construction projects include, but are not limited to, alleys, base courses, bituminous treatments, bridle paths, concrete pavement,
curbs, excavation and embankment (for road construction), fencing (highway), grade crossing elimination (overpasses or underpasses), guard
rails on highways, highway signs, highway bridges (overpasses, underpasses, grade separation), medians, parking lots, parkways, resurfacing
streets and highways, roadbeds, roadways, runways, shoulders, stabilizing courses, storm sewers incidental to road construction, street
paving, surface courses, taxiways, and trails."
Federal Davis-Bacon wage rates as published in U.S. Department of Labor General Wage Decision No. MT080002 Modification No.1 have
been adopted by the Montana Department of Labor and Industry for use in Highway Construction projects and are included in this publication.
These rates apply statewide or as shown in MT080002 Modification No. 1.

D. Definition of Public Works Projects

The Montana Code Annotated (18-2-401 (11)(a)) defines *"public works contract"* as *"a contract for construction services let by the state,*
county, municipality, school district, or political subdivision or for nonconstruction services let by the state, county, municipality, or political
subdivision in which the total cost of the contract is in excess of $25,000..."
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E. Prevailing Wage Schedule

This publication covers only Heavy and Highway Construction occupations and rates in the specific localities mentioned herein. These rates
will remain in effect until superseded by a more current publication. Current prevailing wage rates schedules for Building Construction, and
Nonconstruction Services occupations can be found on the Internet at **www.mtwagehourbopa.com** or by contacting the Labor Standards
Bureau at (406) 444-5600 or TDD (406)
444-5549.

F. Fringe Benefits

Section 18-2-412 of the Montana Code Annotated states:
"(1) To fulfill the obligation... a contractor or subcontractor may:
(a) pay the amount of fringe benefits and the basic hourly rate of pay that is part of the standard prevailing rate of wages directly to the worker

or employee in cash;
(b) make an irrevocable contribution to a trustee or a third person pursuant to a fringe benefit fund, plan, or program that meets the
requirements of the Employee Retirement Income Security Act of 1974 or that is a bona fide program approved by the United States
department of labor; or
(c) make payments using any combination of methods set forth in subsections (1)(a) and (1)(b) so that the aggregate of payments and
contributions is not less than the standard prevailing rate of wages, including fringe benefits for health and welfare and pension contributions
that meet the requirements of the Employee Retirement Income Security Act of 1974, travel, or other bona fide programs approved by the
United States department of labor, that is applicable to the district for the particular type of work being performed.
(2) The fringe benefit fund, plan, or program described in subsection (1)(b) must provide benefits to workers or employees for health care,
pensions on retirement or death, life insurance, disability and sickness insurance, or bona fide programs that meet the requirements of the
Employee Retirement Income Security Act of 1974 or that are approved by the United States department of labor."

Fringe benefits are paid for all hours worked (straight time and overtime hours). However, fringe benefits are not to be considered a part of the
hourly rate of pay for calculating overtime, unless there is a collectively bargained agreement in effect that specifies otherwise.

Employers are obligated to pay the wage rates and fringes as listed in the booklet, including the zone hourly rate when applicable. For heavy
and highway construction occupations, the vacation benefit amount is not included in the prevailing wage rate, unless stated otherwise.

G. Apprentices

Wage rates for apprentices registered in approved federal or state apprenticeship programs are contained in those programs. However,
apprentices not registered in approved federal or state apprenticeship programs will be paid the prevailing wage rate when working on a public
works contract.

H. Posting Notice of Prevailing Wages

Section 18-2-406, Montana Code Annotated, provides that contractors, subcontractors, and employers who are performing work or providing
services under public works contracts, as provided in this part, shall post in a prominent and accessible site on the project or work area, not later
than the first day of work, a legible statement of all wages and fringe benefits to be paid to the employees on such site or work area.

I. Employment Preference

Sections 18-2-403 and 18-2-409, Montana Code Annotated, require contractors to give preference to the employment of bona fide Montana
residents in the performance of work on public works contracts.

J. Rates to Use for Projects

Rates to be used on a public works project are those that are in effect at the time the project and bid specifications are advertised.

MONTANA STATEWIDE PREVAILING
DAVIS-BACON
2009
Rates Effective: May 15, 2009
HEAVY CONSTRUCTION WAGE RATES
General Wage Determinations Issued Under
The Davis-Bacon and Related Acts
State: Montana
Construction Types: Heavy
Counties: Montana Statewide
5
HEAVY CONSTRUCTION PROJECTS
ZONE DEFINITIONS
CARPENTERS, *CEMENT MASONS, LABORERS, AND TRUCK DRIVERS
The zone hourly rates applicable to each project shall be determined by measuring the road miles over the shortest practical maintained route from the
nearest County Court House of the following listed towns to the center of the job:
BILLINGS, BOZEMAN, BUTTE, GREAT FALLS, HAVRE, HELENA, KALISPELL, LEWISTOWN, MILES CITY, MISSOULA
Zone 1: 0 to 30 miles - Base Pay
Zone 2: 31 to 60 miles - Base Pay+ $2.95
Zone 3: 60+ miles - Base Pay+ $4.70
*CEMENT MASONS ZONES: The above cities plus DILLON, GLASGOW, GLENDIVE, SIDNEY

CARP0028-002 05/01/2007
Rates Fringes
CARPENTERS: (Zone 1)
CARPENTER & PILEBUCK $22.00 $8.40
MILLWRIGHT $24.00 $8.40

CARP0028-004 06/01/2006
Rates Fringes
DIVER TENDER $27.27 $7.80
DIVER $56.54 $7.80
DEPTH PAY (Surface Diving)
050 to 100 feet $2.00 per foot
101 to 150 feet $3.00 per foot
151 to 220 feet $4.00 per foot
221 ft & deeper $5.00 per foot

ELEC0044-001 09/01/2008
BEAVERHEAD, BIG HORN, BLAINE, BROADWATER, CARBON, CARTER, CASCADE, CHOUTEAU, CUSTER, DANIELS, DAWSON, DEER LODGE, FALLON, FERGUS, GALLATIN, GARFIELD, GLACIER, GOLDEN VALLEY, GRANITE, HILL, JEFFERSON, JUDITH, BASIN, LEWIS AND CLARK, LIBERTY, MADISON, MCCONE, MEAGHER, MINERAL, MISSOULA, MUSSELSHELL, PARK, PETROLEUM, PHILLIPS, PONDERA, POWDER RIVER,

POWELL, PRAIRIE, RAVALLI, RICHLAND, ROOSEVELT, ROSEBUD, SHERIDAN, SILVER BOW, STILLWATER, SWEET GRASS, TETON, TOOLE, TREASURE, VALLEY, WHEATLAND, WIBAUX, AND YELLOWSTONE COUNTIES.

Rates Fringes

LINE CONSTRUCTION

(1) Lineman $33.90 4.75%+$10.61

(2) Equipment Operator $25.13 4.75%+$10.95

(3) Experienced Groundman $20.27 4.75%+$10.33

ELEC0233-001 06/01/2008

BLAINE, BROADWATER, CASCADE, CHOUTEAU, FERGUS, GLACIER, HILL, JUDITH BASIN, LEWIS & CLARK, LIBERTY, MEAGHER, PETROLEUM, PHILLIPS, PONDERA, TETON, VALLEY, AND WHEATLAND COUNTIES.

Rates Fringes

ELECTRICIAN $27.26 4.25%+$8.55

6

ELEC0233-002 08/01/2007

BEAVERHEAD, DEER LODGE,GRANITE, JEFFERSON, MADISON, POWELL, AND

SILVER BOW COUNTIES.

Rates Fringes

ELECTRICIAN $25.50 4.25%+$9.20

ELEC0532-001 06/01/2008

GALLATIN, PARK, AND SWEET GRASS COUNTIES.

Rates Fringes

ELECTRICIAN $26.29 4.25%+$8.40

ELEC0532-003 06/01/2008

BIG HORN, CARBON, CARTER, CUSTER, DANIELS, DAWSON, FALLON, GARFIELD, GOLDEN VALLEY, McCONE, MUSSELSHELL, POWDER RIVER, PRAIRIE, RICHLAND, ROOSEVELT, ROSEBUD, SHERIDAN, STILLWATER, TREASURE, WIBAUX AND YELLOWSTONE COUNTIES.

Rates Fringes

ELECTRICIAN $26.83 4.25%+$9.39

ELEC0768-001 03/01/2008

FLATHEAD, LAKE, LINCOLN, MINERAL, MISSOULA, RAVALLI, AND SANDERS COUNTIES.

Rates Fringes

ELECTRICIAN $27.10 $10.71

ELEC0768-003 07/02/2007

FLATHEAD, LAKE, AND LINCOLN COUNTIES.

Rates Fringes

LINE CONSTRUCTION

(1) Lineman $32.60 $12.01

(2) Groundman $19.49 $11.01

(3) Line Equipment Operator $24.16 $11.41
(4) Tree Trimmer $26.11 $11.58

ZONE DEFINITIONS FOR POWER EQUPMENT OPERATORS:
The zone hourly rates applicable to each project shall be determined by measuring the road miles over the shortest practical maintained route from the
nearest County Court
House of the following listed towns to the center of the job:
BILLINGS, BOZEMAN, BUTTE, GREAT FALLS, HELENA, KALISPELL, MISSOULA.
Zone 1: 0 to 30 miles - Base Pay
Zone 2: 31 to 60 miles - Base Pay+ $3.50
Zone 3: Over 60 miles - Base Pay+ $5.50
7
ENGI0400-001 05/01/2008
Rates Fringes
POWER EQUIPMENT OPERATOR (Zone 1)
Group 1 $22.47 $9.05
Group 2 $22.94 $9.05
Group 3 $23.34 $9.05
Group 4 $24.00 $9.05
Group 5 $24.50 $9.05
Group 6 $25.60 $9.05
Group 7 $26.10 $9.05
POWER EQUIPMENT OPERATORS CLASSIFICATIONS:
GROUP 1: Air Compressor; Auto Fine Grader; Belt Finishing Machine; Boring Machine, small; Cement Silo; Crane, A-Frame Truck Crane; Crusher
Conveyor; DW-10, 15, and 20 Tractor Roller; Farm Tractor; Forklift; Form Grader; Front-end Loader under 1 cu yd; Heavy Duty Drills; Herman Nelson
Heater; Mulching Machine; Oiler, all except Cranes. & Shovels; Pumpman.
GROUP 2: Air Doctor; Backhoe/Excavator/Shovel to and including 3 cu yd; Bit Grinder; Bituminous Paving Travel Plant; Boring Machine, large; Broom,
self-propelled; Concrete Travel Batcher; Concrete Float & Spreader; Concrete Bucket Dispatcher; Concrete Finish Machine; Concrete Conveyor;
Distributor; Dozer, Rubber- Tired, Push & Side Boom; Elevating Grader/Gradall; Field Equipment Serviceman; Front-end Loader 1 cu yd to including 5 cu
yd; Grade Setter; Heavy Duty Drills, all types; Hoist/Tugger, all; Hydralift & similar; Industrial Locomotive; Motor Patrol, except Finish; Mountain Skidder;
Oiler - Cranes & Shovels; Pavement Breaker, EMSCO; Power Saw, self-propelled; Pugmill; Pumpcrete/Grout Machine; Punch Truck; Roller, other than
Asphalt; Roller, Sheepsfoot,
self- propelled; Roller, 25 tons and over; Ross Carrier; Rotomill under 6 ft; Trenching Machine; Washing/Screening Plant.
GROUP 3: Asphalt Paving Machine; Asphalt Screed; Backhoe/Excavator/Shovel over 3 cu yd; Cableway Highline; Concrete Batch Plant; Concrete
Curing Machine; Concrete
Pump; Cranes, Creter; Cranes, Electric Overhead; Cranes, 24 tons and under; Curb Machine/Slip Form Paver; Finish Dozer; Front-end Loader over 5 cu

yd; Mechanic/Welder; Pioneer Dozer; Roller, Asphalt (Breakdown & Finish); Rotomill, over 6 ft; Scraper, single, twin, or pulling Belly Dump; Yo-Yo Cat.
GROUP 4: Asphalt/Hot Plant Operator; Cranes, 25 tons to 44 tons; Crusher Operator; Finish Motor Patrol; Finish Scraper.
GROUP 5: Cranes, 45 tons to including 74 tons.
GROUP 6: Cranes, 75 tons to including 149 tons; Crane, Whirley (all).
GROUP 7: Cranes, 150 tons to including 250 tons (add $1.00 for every 100 tons over 250 tons); Crane, Stiff-Leg or Derrick; Helicopter Hoist; Crane,
Tower (all).

IRON0014-002 07/01/2008
FLATHEAD, GLACIER, LAKE, LINCOLN, MINERAL, MISSOULA, AND SANDERS COUNTIES.
Rates Fringes
IRONWORKER $23.17 $15.55

IRON0732-009 06/01/2008
REMAINING COUNTIES.
Rates Fringes
IRONWORKER $24.80 $14.61

LABO0098-001 05/01/2005
Rates Fringes
LABORERS: (Zone 1)
Group 1 $15.17 $5.90
Group 2 $17.99 $5.90
Group 3 $18.13 $5.90
Group 4 $18.85 $5.90
8
LABORERS CLASSIFICATIONS:
GROUP 1: Flagperson.
GROUP 2: All General Labor work; Burning Bar; Bucket Man; Carpenter Tender; CaissonWorker; Cement Mason Tender; Cement Handler (dry); Chuck
Tender; Choker Setter; Concrete worker; Curb Machine-Lay Down; Crusher and Batch worker; Fence Erector; Form Setter; Form Stripper; Heater Tender;
Landscaper; PipeWrapper; Pot Tender; Powderman Tender; Rail and Truck Loaders and Unloaders; Riprapper; Sealants for concrete and other
materials; Sign Erection, Guard Rail and Jersey Rail; Stake Jumper; Spike Driver; Signalman; Tail Hoseman; Tool Checker and Houseman; Traffic Control
worker.
GROUP 3: Concrete Vibrator; Dumpman (Grademan); Equipment Handler; Geotextile and Liners; High-Pressure Nozzleman; Jackhammer (Pavement
Breaker); Laser Equipment; Non-Riding Rollers; Pipelayer; Posthole Digger (Power); Power Driven
Wheelbarrow; Rigger; Sandblaster; Sod Cutter-Power; Tampers; Creosote Handler.
GROUP 4: Asphalt Raker; Asbestos Laborer; Cutting Torch; Grade Setter; Hazmat Worker; High - Scaler; Power Saws (Faller & Concrete); Powderman
($1.00 per hour above Group 4 rate); Rock & Core Drill; Tank/Vessel Cleaner; Track or Truck mounted Wagon Drill; Welder including Air Arc.

PAIN0260-001 07/01/2002

BLAINE, BROADWATER, CASCADE, CHOUTEAU, DANIELS, FERGUS, GARFIELD, GLACIER, GRANITE (South of a line running East & West through the Southern city limits of Phillipsburg), HILL, JEFFERSON, JUDITH BASIN, LEWIS AND CLARK, LIBERTY, McCONE, MEAGHER, PETROLEUM, PHILLIPS, PONDERA, POWELL (South of a line running East & West through the Southern City limits of Helmsville), RICHLAND, ROOSEVELT, SHERIDAN, TETON, TOOLE, VALLEY, ANDWHEATLAND COUNTIES.

Rates Fringes

PAINTER $13.85 1%+$3.45

PAIN0260-002 07/01/2002

FLATHEAD, GRANITE (North of a line running East & West through the Southern city limits of Phillipsburg), LAKE, LINCOLN, MINERAL, MISSOULA, POWELL (North of a line running East & West through the Southern city limits of Helmsville), RAVALLI, AND SANDERS COUNTIES.

Rates Fringes

PAINTER $16.85 1%+$3.45

PAIN1922-001 06/01/2001

BEAVERHEAD, BIG HORN, CARBON, CARTER, CUSTER, DAWSON, DEER LODGE, FALLON, GALLATIN, GOLDEN VALLEY, JEFFERSON, MADISON, MUSSELSHELL, PARK, POWDER RIVER, PRAIRIE, ROSEBUD, SILVER BOW, STILLWATER, SWEET GRASS, TREASURE, WIBAUX, AND YELLOWSTONE COUNTIES.

Rates Fringes

PAINTER (Industrial, includes industrial plants, tanks, pipes, bridges) $17.80 $7.63

PLAS0119-001 05/01/2008

AREA 1: STATEWIDE (except Deer Lodge, Jefferson, Powell, and Silver Bow Counties).

AREA 2: DEER LODGE, JEFFERSON, POWELL, AND SILVER BOW COUNTIES.

Rates Fringes

CEMENT MASONS: (Zone 1)

Area 1 $18.83 $6.96

Area 2 $20.24 $6.86

9

PLUM0030-003 09/01/2008

BIGHORN, BLAINE, CARBON, CARTER, CASCADE, CHOUTEAU, CUSTER, DANIELS, DAWSON, FALLON, FERGUS, GARFIELD, GOLDEN VALLEY, HILL, JUDITH BASIN, LIBERTY, McCONE, MEAGHER, MUSSELSHELL, PETROLEUM, PHILLIPS, PONDERA, POWDER RIVER, PRAIRIE. RICHLAND, ROOSEVELT, ROSEBUD, SHERIDAN, STILLWATER, TETON, TOOLE, TREASURE, VALLEY, WHEATLAND, WIBAUX AND YELLOWSTONE COUNTIES.

Rates Fringes

PLUMBER
Commercial $27.15 $12.95
Industrial – Power Generating Plants $29.50 $12.95

PLUM0041-001 07/01/2008
BEAVERHEAD, BROADWATER, DEER LODGE, GALLATIN, GRANITE, JEFFERSON, LEWIS AND CLARK, MADISON, PARK, POWELL, SILVER BOW, AND SWEET GRASS COUNTIES.
Rates Fringes
PLUMBER $28.00 $10.75

PLUM0459-001 05/01/2008
FLATHEAD, GLACIER, LAKE, LINCOLN, MINERAL, MISSOULA, RAVALLI, AND SANDERS.
Rates Fringes
PLUMBER $26.36 $11.05

TEAM0002-001 05/01/2008
Rate Fringes
TRUCK DRIVERS: (Zone 1)
Group 1 $14.14 $5.92
Group 2 $18.84 $5.92
TRUCK DRIVERS CLASSIFICATIONS:
GROUP 1: Pilot Car.
GROUP 2: All Combination Trucks and Concrete Mixers; Distributor Driver; All Dry Batch Trucks; Dumpman, Gravel Spreader Box Operator; All Dump Trucks and similar equipment including DW 20, DW 21, or Euclid Tractor; Dumpsters; Flat Trucks; Servicemen; Lowboys, Four-Wheel Trailers; Float Semi-Trailer; Lumber Carriers, Lift Trucks & Fork Lifts; Pick-up Driver hauling material; Powder Truck (Bulk Unloader type); Power Boom; Service Truck Drivers, Fuel Truck Drivers, Tiremen; All Water Tank Drivers; Petroleum Products Drivers; Trucks with Power Equipment such as Winch, A-Frame Truck, Crane, Hydralift, Gout-Crete Truck, and Combination Mulching, Seeding & Fertilizing Truck; Truck Mechanic.

WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.
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END OF GENERAL DECISION
10
MONTANA STATEWIDE PREVAILING
DAVIS-BACON
2009
Rates Effective: May 15, 2009
HIGHWAY CONSTRUCTION WAGE RATES
General Wage Determinations Issued Under
The Davis-Bacon and Related Acts
State: Montana

Construction Types: Highway
Counties: Montana Statewide
11

HIGHWAY CONSTRUCTION PROJECTS

ZONE PAY

CEMENTS MASONS, IRON WORKERS, LABORERS, POWER EQUIPMENT OPERATORS, TRUCK DRIVERS.

The hourly wage rates applicable to each project shall be determined by measuring the road miles over the shortest practical maintained route from the nearest County Court House of the following towns to the center of the job:

BILLINGS, BOZEMAN, BUTTE, GREAT FALLS, HAVRE, HELENA, KALISPELL, LEWISTOWN, MILES CITY, MISSOULA.

ZONE 1: 0 to 30 miles - Free
ZONE 2: 31 to 60 miles - Base Pay+ $2.50
ZONE 3: 60+ miles - Base Pay+ $4.00

CARPENTERS:
ZONE 1: 0 to 30 miles - Free
ZONE 2: 31 to 50 miles - Base Pay+ $3.00
ZONE 3: 50+ miles - Base Pay+ $4.80

Rates Fringes
CARPENTER
CARPENTER, PILEDRIVERMAN $22.71 $8.85
MILLWRIGHT $24.78 $8.85

Rates Fringes
CEMENT MASON
$21.37 $8.50

Rates Fringes
ELECTRICIAN
Area 1 $18.74 $2.93+3.8%
Area 2 $20.13 $4.76+3.8%
Area 3 $19.98 $3.44+3.8%
Area 4 $19.84 $3.51+3.8%
Area 5 $20.54 $3.54+3.8%
Area 6 $18.02 $3.44+3.8%

ELECTRICIANS AREA DESCRIPTIONS

AREA 1: Beaverhead, Deer Lodge, Granite, Jefferson, Madison, Silver Bow, and Powell Counties.

AREA 2: Big Horn, Carbon, Carter, Custer, Dawson, Fallon, Garfield, Golden Valley, Musselshell, Powder River, Prairie, Rosebud, Stillwater, Treasure, Wibaux, and Yellowstone Counties.

AREA 3: Blaine, Cascade, Chouteau, Daniels, Fergus, Glacier, Hill, Judith Basin, Liberty, McCone, Petroleum, Pondera, Phillips, Richland, Roosevelt, Sheridan, Teton, Toole, Valley, and Wheatland Counties.

AREA 4: Broadwater, Lewis and Clark, and Meagher Counties.

AREA 5: Flathead, Lake, Lincoln, Mineral, Missoula, Ravalli, and Sanders Counties.

AREA 6: Gallatin, Park, and Sweet Grass Counties.

IRONWORKER

Flathead, Glacier, Lake, Lincoln, Mineral, Missoula and Sanders Counties.

Rates Fringes

$25.50 $14.36

Remaining Counties.

Rates Fringes

$23.15 $13.71

12

Rates Fringes

LABORER

Group 1 $17.18 $6.75

Group 2 $19.97 $6.75

Group 3 $20.17 $6.75

Group 4 $21.07 $6.75

LABORERS CLASSIFICATIONS

GROUP 1: Flag person.

GROUP 2: All General Labor work; Burning Bar; Bucket Man; Carpenter Tender; CaissonWorker; Cement Mason Tender; Cement Handler (dry); Chuck Tender; Choker Setter; Concrete worker; Curb Machine-Lay Down; Crusher and Batch Plant Worker; Fence Erector; Form Setter; Form Stripper; Heater Tender; Landscaper; Pipe Wrapper; Pot Tender; Powderman Tender; Rail and Truck Loaders and Unloaders; Riprapper; Sealants for Concrete and other materials; Sign Erection, Guard Rail and Jersey Rail; Stake Jumper; Spike Driver; Signalman; Tail Hoseman; Tool Checker and Houseman; Traffic Control Worker.

GROUP 3: Concrete Vibrator; Dumpman (Grademan); Equipment Handler; Geotextile and Liners; High-Pressure Nozzlemen; Jackhammer (Pavement Breaker); Laser equipment; Non-riding Rollers; Pipelayer; Posthole Digger (power); Power Driven Wheelbarrow; Rigger; Sandblaster; Sod Cutter-power; Tampers.

GROUP 4: Ashpalt Raker; Cutting Torch; Grade Setter; High - Scaler; Power Saws (Faller & Concrete); Powderman ($1.00 per hour above Group 4 rate); Rock & Core Drill; Track or Truck mountedWagon Drill; Welder including Air Arc.

Rates Fringes

LINE CONSTRUCTION

Equipment Operator $19.16 $5.05

Groundman $15.40 $5.05

Rates Fringes

PAINTER

$24.00 $8.00

Pavement Marking/Milling and related work. Includes operating marking and all other equipment and all work involved in traffic marking including removal, surface preparation and application of pavement markings including epoxies, paints, tape, buttons, thermo- plastics and any other products applied for traffic marking purposes and for directing and regulating traffic, and cutting Rumble Strips.

Rates Fringes
POWER EQUIPMENT OPERATOR
Group 1 $21.52 $8.00
Group 2 $23.55 $8.00
Group 3 $24.41 $8.00
Group 4 $25.10 $8.00
Group 5 $26.44 $8.00
Group 6 $27.13 $8.00
Group 7 $29.23 $8.00

POWER EQUIPMENT OPERATORS CLASSIFICATIONS

GROUP 1: A-Frame Truck Crane; Air Compressor; Auto Fine Grader; Belt Finishing Machine; Boring Machine (small); Cement Silo, Crane; Crusher Conveyor, DW-10, 15, and 20 Tractor Roller; Farm Tractor; Forklift; Form-Grader; Front-end Loader under 1 cu yd; Oiler, Heavy Duty Drills; Pumpman; Oiler (All, except Cranes and Shovels).

GROUP 2: Air Doctor; Backhoe/Excavator/Shovel to & incl 3 cu yd Bit Grinder; Bitunimous Paving Travel Plant; Boring Machine, large: Broom, Self-Propelled; Concrete Bucket Dispatcher; Concrete Conveyor; Concrete Finish Machine; Concrete Float and Spreader; Concrete Travel Batcher; Distributor; Dozer, Rubber tired, Push, and Side Boom; Drills, Heavy Duty (all types); Elevating Grader/Gradall; Field Equipment Serviceman; Front-end Loader 1 cu yd to and incl. 5 cu yd; Grade Setter; Hoist/Tugger (All Hydralift & Similar); Industrial Locomotive; Motor Patrol (Except Finish); Mountain Skidder; Oiler, Cranes & Shovels; Pavement Breaker, EMSCO; Power Saw, Self-Propelled; Pugmill; Pumpcrete/ Grout Machine; Punch Truck; Rollers (All except Asphalt Finish and Breakdown); Ross Carrier; Rotomill under 6 ft; Trenching Machine; Washing/Screening Plant.

GROUP 3: Asphalt Finish Roller; Asphalt Breakdown Roller; Asphalt Paving Machine; Backhoe/Excavator/Shovel larger than 3 cu yd; Asphalt Screed; Concrete Batch Plant; Cableway Highline; Concrete Curing Machine; Cranes, 24 tons & under; Cranes, Creter; Cranes, Electric Overhead; Concrete Pump; Curb Machine/Slip Form Paver; Finish Dozer; Mechanic/Welder; Pioneer Dozer; Rotomill 6 ft and over; Scraper, Single Engine; Scraper Twin or pulling Belly Dump; Yo Yo Cat Front-end Loader over 5 cu yd.

GROUP 4: Asphalt/Hot Plant Operator; Cranes, 25 tons to 44 tons; Crusher Operator; Finish Motor Patrol; Finish Scraper.

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SPECIAL OPERATORS:

GROUP 5: Cranes, 45 tons to and including 74 tons.

GROUP 6: Cranes, 75 tons to and including 149 tons.

GROUP 7: Cranes, 150 tons to and including 250 tons; Cranes over 250 tons: add $1.00 for every 100 tons over 250 tons; Crane, Stiff-Leg or Derrick; Crane, Tower all); Crane, Whirley (all); Helicopter Hoist.

Rates Fringes
TRUCK DRIVER
Group 1 $18.54 $7.86
Group 2 $23.69 $7.86

GROUP 1: Pilot Car.

GROUP 2: Combination Truck and Concrete Mixer and Transit Mixer; Dry Batch Trucks; Distributor Driver; Dumpman; Dump Trucks and similar equipment; Dumpster; Flat Trucks; Lumber Carriers; Lowboys; Pickup; Powder Truck Driver; Power Boom; Serviceman; Service Truck/Fuel Truck/Tireperson; Truck Mechanic; Trucks with Power Equipment; Warehouseman, Partsman, Cardex and Warehouse Expeditor; Water Trucks.

WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

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END OF GENERAL DECISION

Exhibit G

Required Insurance Coverage

Contractor shall purchase and maintain insurance coverage as set forth below. The insurance policy must, unless not available from the insured, name the City as an additional insured and be written on a "primary—noncontributory basis." Each coverage shall be obtained from an insurance company that is duly licensed and authorized to transact insurance business and write insurance within the state of Montana, with a minimum of "A.M. Best Rating" of A-, VI, as will protect the Contractor, the various acts of subcontractors, the City and its officers, employees, agents, and representatives from claims for bodily injury and/or property damage which may arise from operations and completed operations under this Agreement. All insurance coverage shall remain in effect throughout the life of this Agreement and for a minimum of one (1) year following the date of expiration of Contractor's warranties. All insurance policies must contain a provision or endorsement that the coverage afforded will not be canceled, materially changed, or renewal refused until at least forty-five (45) days prior written notice has been given to Contractor, City, and all other additional insured to whom a certificate of insurance has been issued.

Required Insurance Coverage:

1.	Comprehensive General Liability (bodily injury and property damage)	$1,500,000 per occurrence $3,000,000 aggregate
2.	Products and Completed Operations	$3,000,000
3.	Automobile Liability (all owned, hired, non-owned)	$1,500,000 per accident
4.	Workers' Compensation	Not less than statutory limits
5.	Employers' Liability	$1,500,000
6.	Professional Liability (E&O) (only if applicable)	$1,500,000

7. Builder's Risk/Property Insurance (for buildings) Equal to greater of Contractor's compensation or full replacement (covering all work. buildings, materials and equipment, whether on site or in transit, loss due to fire, lightening, theft, vandalism, malicious mischief, earthquake, collapse, debris removal, demolition occasioned by enforcement of laws, water damage, flood if site within a flood plain, repair or replacement costs, testing and start-up costs)

8.	Owner's and Contractor's Protective Liability	$1,000,000 per occurrence $3,000,000 aggregate
9.	Contractual Liability Insurance (covering indemnity obligations)	$1,000,000 per occurrence $3,000,000 aggregate

Additional coverage may be required in the event of the following:

crane operating services: add On-Hook Coverage

transportation services: add $1,000,000 Transit Coverage

Exhibit H

Required Bonds

Contractor shall make, execute, purchase, maintain and deliver to City performance and payment bonds in an amount at least equal to the Contractor's compensation under this Agreement, conditioned that the Contractor shall faithfully perform of all of Contractor's obligations under this Agreement and pay all laborers, mechanics, subcontractors, material suppliers and all persons who supply the Contractor or Contractor's subcontractors with provisions, provender, material, or supplies for performing work on the Construction Project. All bonds must be obtained with a surety company that is duly licensed and authorized to transact business within the state of Montana and to issue bonds for the limits so required. The surety company must have a Best's Financial Strength Rating of A, as rated by the A. M. Best Co., or an equivalent rating from a similar rating service. All bonds must remain in effect throughout the life of this Agreement and for a minimum of one (1) year following the date of expiration of Contractor's warranties. A certified copy of the agent's authority to act must accompany all bonds signed by an agent. If the surety on any bond furnished by Contractor is declared bankrupt or becomes insolvent or its right to do business within the state of Montana is terminated, Contractor shall promptly notify City and shall within twenty (20) days after the event giving rise to such notification, provide another bond with another surety company, both of which shall comply with all requirements set forth herein.

Bond Types and Amounts:

1.	Performance Bond	Equal to Contractor's compensation amount
2.	Labor and Materials Bond	Equal to Contractor's compensation amount

PERFORMANCE BOND

_____

(Insert full legal name and address of Contractor)

_____

_____

as Principal, hereinafter called CONTRACTOR, and:

_____

(Insert full legal name and address of Surety)

as Surety, hereinafter called SURETY, are held and firmly bound unto:

City of Helena
316 North Park Avenue
Helena, MT 59623

as Obligee, hereinafter called CITY, in the amount of:

_____**(Dollars) ($_____)**

for the payment, whereof CONTRACTOR and SURETY bind themselves, their heirs, executors, administrators, successors, and assigns, jointly and severally.

WHEREAS, CONTRACTOR has, by written agreement dated _____ 20___,
entered into a contract with CITY for:

_____

(Insert project name)

in accordance with drawings and specifications prepared by:

_____

(Insert company name)

which contract is by reference made a part hereof, and is hereinafter referred to as the Agreement.

NOW, THEREFORE, the condition of this obligation is such that if CONTRACTOR shall promptly and faithfully perform said Agreement, then this obligation shall be null and void; otherwise it shall remain in full force and effect. As a minimum, this obligation shall remain in full force and effect beyond the completion of all work to include the correction period as specified in the Contract Documents.

The SURETY hereby waives notice of any alteration or extension of time made by CITY.

Whenever CONTRACTOR shall be, and declared by CITY to be, in default under the Agreement, CITY having performed CITY's obligations thereunder, the SURETY may promptly remedy the default or shall promptly:

1. **Complete the Agreement in accordance with its terms and conditions; or**

2. **Obtain a bid or bids for completing the Agreement in accordance with its terms and conditions, and upon determination by SURETY of the lowest responsible bidder, or, if CITY elects, upon determination by CITY and the SURETY jointly of the lowest responsible bidder, arrange for a contract between such bidder and CITY, and make available as work progresses (even though there should be a default or a succession of defaults under the contract or contracts of completion arranged under this paragraph) sufficient funds to pay the cost of completion less the balance of the contract price; but not exceeding, including other costs and damages for which SURETY may be liable hereunder, the amount set forth in the first paragraph hereof. The term "balance of the contract price," as used in this paragraph, shall mean the total amount payable by CITY to CONTRACTOR under the Agreement and any amendments thereto, less the amount properly paid by CITY to CONTRACTOR.**

No right of action shall accrue on this Bond to or for the use of any person or corporation other than CITY named herein or the heirs, executors, administrators, or successors of CITY.

IN WITNESS WHEREOF, this instrument is executed in _____ (____) counterparts, each one

(number)

of which shall be deemed an original, this the _____ day of _____, 20___.

CONTRACTOR AS PRINCIPAL:	**SURETY:**
_____ (Seal)	_____
Company Name	**Surety Name and Corporate Seal**
By: _____ (Seal)	**By:** _____
Signature	**Signature**
Printed Name	**Attorney-in-Fact**
	_____
	Printed Name
	(Attach Power of Attorney)
_____	
Title	
Attest: _____	**Attest:** _____
Signature	**Signature**

Title	**Title**

NOTE: Date of Bond must not be prior to date of Contract. If CONTRACTOR is a partnership, all partners must execute Bond.

PAYMENT BOND

_____

(Insert full legal name and address of Contractor)

_____

_____

as Principal, hereinafter called CONTRACTOR, and:

_____

(Insert full legal name and address of Surety)

as Surety, hereinafter called SURETY, are held and firmly bound unto:

City of Helena
316 North Park Avenue
Helena, MT 59623

as Obligee, hereinafter called CITY, for the use and benefit of claimants as hereinbelow defined in the amount of:

_____**(Dollars) ($**_____**)**

for the payment, whereof CONTRACTOR and SURETY bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally.

WHEREAS, CONTRACTOR has, by written agreement dated _____
20___,
entered into a contract with CITY for:

_____

(Insert project name)

in accordance with drawings and specification prepared by:

_____

(Insert company name)

which contract is by reference made a part hereof, and is hereinafter referred to as the Agreement.

NOW, THEREFORE, the condition of this obligation is such that if CONTRACTOR shall promptly make payments to all claimants as hereinafter defined, for all labor and materials used or reasonably required for use in the performance of the Agreement, and any duly authorized modifications that may hereafter be made, then this obligation shall be void; otherwise, it shall remain in full force and effect, subject, however, to the following conditions:

1. **A claimant is defined as one having a direct contract with the CONTRACTOR or with a subcontractor of CONTRACTOR as defined by Title 18, Chapter 2, Part 2, MCA, for labor, materials, or both, used or**

reasonably required for use in the performance of the Agreement; labor and material being construed to include that part of water, gas, power, light, heat, oil, gasoline, telephone service or rental of equipment directly applicable to the Agreement.

2. **The above named CONTRACTOR and SURETY hereby jointly and severally agree with CITY that every claimant as herein defined who has not been paid in full before the expiration of a period of ninety (90) days after the date on which the last of such claimant's work or labor was done or performed, or materials were furnished by such claimant, may sue on this Bond for the use of such claimant in the name of CITY, prosecute the suit to final judgment for such sum or sums as may be justly due claimant, and have execution thereon, provided, however, that CITY shall not be liable for the payment of any costs or expenses of any such suit.**

3. **A claimant may only commence a suit or action:**

   a. If the claimant has complied with applicable state laws; and

   b. In District Court located in and for Lewis & Clark County, Montana, in Helena City Court, if applicable, or in the United States District Court for the district in which the project, or any part thereof, is situated and not elsewhere.

4. **Special exceptions:** _____

_____

5. **The amount of this Bond shall be reduced by and to the extent of any payment or payments made in good faith hereunder, inclusive of the payments by SURETY of construction liens which may be filed on record against said improvement, whether or not claim for the amount of such lien be presented under and against this Bond.**

IN WITNESS WHEREOF, this instrument is executed in _____ (____) counterparts, each one
(number)

of which shall be deemed an original, this the _____ day of _____, 20___.

CONTRACTOR AS PRINCIPAL:

_____ (Seal)

Company Name

By: _____ (Seal)
Signature

_____
Printed Name

_____
Title

Attest: _____
Signature

_____
Title

SURETY:

_____

Surety Name and Corporate Seal

By: _____
Signature **Attorney-in-Fact**

_____
Printed Name
(Attach Power of Attorney)

Attest: _____
Signature

_____
Title

NOTE: Date of Bond must not be prior to date of Contract. If CONTRACTOR is a partnership, all partners must execute Bond.

SECTION 00950

STANDARD MODIFICATIONS to MPWSS

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SM-00001 GENERAL

These Standard Modifications apply changes, deletions, and additions to the Montana Public Works Standard Specifications Fifth Edition, March 2003 and 2006 Addendum, referred to collectively as the MPWSS. Each Section of the MPWSS that has been modified is listed in the Table of Contents of Section 00950 Standard Modifications to MPWSS. The entire Section from the MPWS has not been rewritten for these modifications. Instead, modifications are indicted for a specific subsection, paragraph, sentence or drawing.

Where a Standard Modification to MPWSS does not exist for a particular Section of MPWSS it shall be assumed the work is to be completed in accordance with the appropriate MPWSS Section. When a Standard Modification to MPWSS does exist the requirements of that modification supersede the related MPWSS requirement. Where paragraphs are specifically deleted or modified, or new paragraphs added, all other parts of the MPWSS will remain in effect unless otherwise modified by the Project Manual in accordance with the order of governance as specified in "Summary of Work".

Forms included in the Project Manual will be used in lieu of similarly titled forms in the MPWSS. Where Technical Specifications follow these Modifications in later Divisions of the Project Manual, those Specifications replace same numbered specifications in the MPWSS.

Delete Part 4: MEASUREMENT AND PAYMENT in all sections of the MPWSS. Payment for an item will only be made if that item is listed as a Bid Item in Section 00300: Bid Form. If an item is listed as a Bid Item, administrative and procedural requirements will be listed in Section 01275: Measurement and Payment. If an item is not listed as a Bid Item, the item is not required or is considered an incidental cost to other Bid Items.

SM-01010 SUMMARY OF WORK

Delete Section 01010.1.2.D and replace with the following:

D. The various portions of the Contract documents, of which these specifications are a part, are essential parts of the Agreement, and a requirement occurring in one is as binding as though occurring in all. All portions are intended to be complementary and to describe and provide for complete work as referenced in Article 3, General Conditions. Unless specifically noted otherwise, in the case of discrepancy, the following precedence will govern.

1. Permits from Town/City/County Departments and other agencies as may be required by law, which will govern over;

2. Change Orders, which will govern over;

3. Executed Agreement, which will govern over;

4. Addenda, which will govern over;

5. Special Provisions, which will govern over;

6. Divisions 1 through Division 16 Technical Specifications, which will govern over;

7. Funding Agency Special Provisions for Montana Public Facility Projects, which will govern over;

8. Standard Modifications to the Montana Public Works Standard Specifications, which will govern over;

9. Supplementary Conditions to the General Conditions, which will govern over;

10. General Conditions, which will govern over;

11. Drawings, which will govern over;

12. Contractor's Bid, which will govern over;

13. Montana Public Works Standard Specifications 2006 Addendum, which will govern over;

14. Montana Public Works Standard Specifications, Fifth Edition, March 2003, which will govern over;

15. Montana Department of Transportation Standard Specifications for Road and Bridge Construction, which will govern over;

16. Reference Specifications, which will govern over;

With reference to Drawings, the order of precedence is as follows:

1. Addenda/Change Order Drawings govern over any other Drawings.

2. Figures govern over scaled dimensions.

3. Contract Detail Drawings govern over Contract General Drawings.

4. Contract Drawings govern over Standard Drawings.

SM-01041 PROJECT COORDINATION

Delete Section 01041 in its entirety and replace with Section 01041: PROJECT COORDINATION contained in the Project Manual.

SM-01050 FIELD ENGINEERING

Delete Section 01050 in its entirety.

SM-01300 SUBMITTALS

Delete Section 01300 in its entirety and replace with Section 01300: SUBMITTALS contained in the Project Manual.

SM-01400 CONTRACTOR QUALITY CONTROL AND OWNER QUALITY ASSURANCE

Delete Section 01400 in its entirety and replace with Section 01400: CONTRACTOR QUALITY CONTROL AND OWNER QUALITY ASSURANCE contained in the Project Manual.

SM-01500 CONSTRUCTION AND TEMPORARY FACILITIES

Delete Section 01500 in its entirety and replace with Section 01500: CONSTRUCTION AND TEMPORARY FACILITIES contained in the Project Manual.

SM-01570 CONSTRUCTION TRAFFIC CONTROL

Delete Sections 01570.1.3.B and C and replace with the following:

B. Prepare traffic control Drawings and submit to the Engineer for approval at least 14 days prior to the beginning of construction or change in a zone of work. Do not commence work until said plan is approved.

C. Cooperate with the Engineer and the Owner to adjust traffic control Drawings as required to fit specific field conditions. Modifications to construction timing based upon field adjustments to the traffic control plan will not constitute a claim for additional payment to the Contractor.

D. The Engineer will forward traffic control Drawings and subsequent changes to the Drawings to the Montana Department of Transportation (MDT) for any work performed within MDT right-of-way. The Contractor is responsible for making all modifications to traffic control Drawings required by MDT based upon their review. No time extension will be given for delays caused by failure to gain approval of plan by MDT.

E. Notify all impacted parties (including but not limited to landowners, businesses, and residents adjacent to the work, local utilities, City and County personnel, emergency services, school district transportation directors, and the postal service) regarding the type and duration of the construction.

F. For project sites involving a through street, provide the Engineer with a news release when submitting the traffic control Drawings. Include in the release, as a minimum, the work activity and duration. Once approved, furnish the news release to the local media at least 2 weeks before starting work.

Add Section 01570.1.4.

1.4 TRAFFIC CONTROL OFFICER

A. Name one employee responsible to coordinate traffic control for the entirety of the project. Assure the individual responsible for traffic control remains on-site whenever construction activity is taking place.

Delete Section 01570.3.1.B and replace with the following.

B. Inspect the work area at least twice a day during construction, including weekends, holidays, and other non-working days. Correct all deficiencies discovered during inspections and assure traffic control is appropriate to the work. Maintain records of traffic control devices used and their location and daily checklists, signed by the traffic control officer, for each inspection.

Delete Section 01570.3.2.C and replace with the following.

C. The Contractor is solely responsible for the construction traffic control system including removing, repairing, or replacing any traffic control device not providing its intended function. The Engineer will periodically observe the traffic control for compliance with the approved traffic control Drawings and inform the Contractor of any discovered non-compliance.

SM-01700 CONTRACT CLOSEOUT

Delete Section 01700 in its entirety and replace with Section 01700: CONTRACT CLOSEOUT contained in the Project Manual.

SM-02110 GEOTEXTILES

Delete Section 02110.2.1.A and replace with the following.

A. Assure that fibers used in the manufacture of geotextiles, and the threads used in joining geotextiles by sewing, consist of long-chain synthetic polymers, composed of at least 95 percent by weight polyolefins or polyesters. They must be formed into a network so the filaments on yarns retain dimensional stability relative to each other, including selvedges. Furnish materials meeting the physical requirements listed in Section 2.4 or as shown on the plans.

Add Section 02110.2.1.B

B. Provide moderate or high survivability non-woven polypropylene fabric that is inert to commonly encountered chemicals and soils and that remains stable over a temperature range of -50 degrees Fahrenheit (-46° C) to 150 degrees Fahrenheit (66° C) and at a pH range of 2 to 13.

Add Section 02110.2.3.B

B. At the time of installation, the fabric will be rejected if it has defects, seams or weakness, rips, holes, flaws, deterioration, or damage incurred during manufacture, transportation or storage.

Add Section 02110.2.4

2.4 MATERIALS

A. Drainage Fabric.

1. Furnish Class 2 fabric as specified in AASHTO M 288 – Geotextile Specifications for Highway Applications.

B. Separation Fabric.

1. Furnish Class 1 fabric as specified in AASHTO M 288 – Geotextile Specifications for Highway Applications.

C. Stabilization Fabric.

1. Furnish Class 1 fabric as specified in AASHTO M 288 – Geotextile Specifications for Highway Applications.

D. Permanent Erosion Control Fabric.

1. Furnish Class 1 fabric, as specified in AASHTO M 288 – Geotextile Specifications for Highway Applications, with an Apparent Opening size of #40, #60, #70, or #100 (US Sieve No.), as shown on the plans.

E. Silt Fence Fabric.

1. Support silt fence with either wood or metal fence posts.

2. Assure silt fence geotextile meets the minimum requirements in the following table:

Required Properties for Silt Fence		
Property	Test Method	Value
Minimum Grab Tensile Strength (lbs)	ASTM D4632	≥125
Minimum Grab Tensile Strength, X Direction (lbs)	ASTM D4632	≥100
Minimum Permittivity (sec^{-1})	ASTM D4491	≥0.05
Maximum Apparent Opening (US Sieve No.)	ASTM D4751	#30
Ultraviolet Stability (% Retained After 500 hrs of Exposure)	ASTM D4355	≥70

F. Landfill Cell Filter Fabric.

1. Assure landfill cell filter fabric minimum requirements in the following table:

Required Properties for Landfill Cell Filter Fabric		
Property	Test Method	Value
Minimum Grab Tensile Strength (lbs)	ASTM D4632	390
Grab Tensile Elongation (%)	ASTM D4632	50
Puncture (lb)	ASTM D4833	240
Maximum Apparent Opening Size (US sieve number)	ASTM D4751	100

Delete Section 02110.3.3.B and C and replace with the following.

B. Overlap geotextile a minimum of 24 inches (60 cm) at the ends and sides of adjoining sheets or sew the geotextile joints according to the manufacturer's recommendations. Overlap the uphill or upstream sheet over the downhill or downstream sheet. Offset end joints of adjacent sheets a minimum of 5 feet (1.5 m). Pins may be used to hold the geotextile sheets in place other than on interior slopes of lagoons or ponds. Space pins along the overlaps at approximately 3 foot (1 m) centers.

C. Place aggregate, slope protection, or riprap on the geotextile starting at the toe of the slope and proceed upward. Place materials by overhead construction methods or in such a manner that no vehicles or equipment operate directly on the fabric. Place riprap onto the geotextile from a height of less than 12 inches (30 cm). Place slope protection rock or aggregate backfill onto the geotextile from a height less than 3 feet (1 m). In underwater applications, place the geotextile and cover material in the same day.

SM-02112 REMOVAL OF EXISTING PAVEMENT, CONCRETE CURB, SIDEWALK, DRIVEWAY, AND/OR STRUCTURES

Delete Section 02212.3.1.C and replace with the following.

C. Remove and dispose of existing private concrete driveways and/or sidewalks which interfere with construction of street improvements or which do not match new grade as shown on the contract documents or as directed by the Engineer. Remove such driveways and/or sidewalks to distance of 8 inches (20 cm) behind curbs, or to greater distance if required to properly match the new curb and gutter grade. Remove along the neat line produced by a concrete saw cut. Make cuts to a depth of the thickness of the driveway and/or sidewalk or to a maximum depth of 6 inches (15 cm), whichever is lesser, and take care in removing the concrete assuring the slab breaks on the sawed neat line.

SM-02113 ADJUSTING EXISTING MANHOLES, LAMPHOLES, INLETS, WATER VALVE BOXES, WATER SERVICES, AND FIRE HYDRANTS TO GRADE

Delete Section 02113.3.1.E and replace with the following.

D. Provide backfill material conforming to the requirements of Section 02235, 1 inch (25 mm) Minus Crushed Base Course, and compacted to at least 97 percent of the maximum dry density as determined by AASHTO T99 or ASTM D698.

SM-02114 RELOCATING OR REMOVING UTILITY POLES, STREET SIGNS, AND MAILBOXES

Delete Section 02114.3.1.A and replace with the following.

A. Affected utility companies are to move power, street light, and telephone poles, unless they are designated in the contract documents to be removed or relocated by the Contractor. If a utility company is non-responsive, notify Engineer. Coordinate all utility relocation activity with the construction activity.

SM-02221 TRENCH EXCAVATION AND BACKFILL FOR PIPELINES & APPURTENANT STRUCTURES

Add the following publications to the list in Section 02221.1.2.A.

ASTM D4235	Relative Density
ASTM D4254	Relative Density

In Section 02221.1.3, delete the reference to Standard Drawings 02221-1: Typical Utility Trench Detail and refer to the attached Modified Standard Drawing 02221-1.

Delete Section 02221.1.4.A.1 replace with the following.

1. Meet the testing requirements of Special Provisions and Section 01400: Contractor Quality Control and Owner Quality Assurance.

Delete Section 02221.1.4.A.3 and replace with the following.

3. Re-testing failing areas is at the expense of the Contractor. Where Engineer provides testing on behalf of the Owner, the Contractor will be assessed the cost of all retests conducted by the Engineer, with that cost deducted from the progress payments.

Delete Section 02221.1.4.B.1 and replace with the following.

1. Quality assurance tests will be made by the Contractor for each on-site natural soil or each source of off-site material, including borrow material, to determine the laboratory maximum density values and optimum compaction moisture content according to ASTM D698.

Delete Section 02221.1.4.C.3 and replace with the following.

3. Submit to the Engineer laboratory moisture-density relationship testing results of on-site and off-site borrow soils.

Delete Section 02221.2.1.A and replace with the following.

A. TYPE 1 PIPE BEDDING

1. Type 1 Pipe Bedding includes the material placed from 4 inches (10 cm) below the bottom of the pipe to 6 inches (15 cm) over the pipe.

2. Provide Type 1 Bedding consisting of crushed stone or gravel, which is free of cementitious substances or thin, flat particles in an amount that would cause the material to cake, pack, or otherwise form and unyielding support for the pipe.

3. Provide imported granular material with a gradation as follows and a maximum plasticity index of 6, determined by AASHTO T89 and T90 or by ASTM D4318.

Percent by Weight Passing	
Sieve Size	% Passing
1" (25 mm)	100
3/4" (19.0 mm)	90 - 100
3/8" (9.5 mm)	20 - 55
No. 4 (4.75 mm)	5 - 10
No. 8 (2.36 mm)	0 - 5

4. Crush material so that the percentage of fractured particles in the finished product is as constant and uniform as practical. Crush to produce material where at least 50 percent of the material retained on the No. 4 sieve has at least one fractured face.

5. To prevent migration of material from around the pipe, do not use sand, sandy gravel, or a material composed mainly of sand for bedding material in the pipe zone where ground water is or will be present or where existing material contains voids which would allow migration. Where trench excavation encounters wet or unstable material, Type 1 Pipe Bedding must be well graded, free draining, and non-plastic.

6. Refer to the Special Provisions and details in the Drawings for other requirements.

Delete Section 02221.2.1.B in its entirety.

Delete Section 02221.2.1.D.3 and replace with the following.

3. Type 2 Bedding consists of granular material meeting the following gradation and having a maximum plasticity index of 6 and a maximum liquid limit of 25 percent.

Percent by Weight Passing	
Sieve Size	Type B-Modified
3" (75 mm)	100
No. 4 (4.75 mm)	0 - 25
No. 8 (2.36 mm)	0 - 10

Delete Section 02221.3.3.A.8 and replace with the following.

8. No classification of trench excavated material materials will be made. Excavation and trenching work includes the removal and subsequent handling of all earth, loose or cemented gravel, loose or solid rock, and other materials excavated or otherwise removed in performance of the contract work, regardless of the type, character, composition, or condition thereof. All materials excavated or otherwise removed including asphalt, curb, gutter, sidewalk, soils, etc., will become the property of the Contractor, who will be responsible for environmentally sound disposal of said material in accordance with state and federal regulations.

Add Section 02221.3.3.B.2.b.

b. If the trench is excavated wider than the specified minimum, provide Type 1 Pipe Bedding for the additional width to yield a consistent backfill for the entire width of the trench or take such other measures as the Engineer may direct to protect the pipe against the crushing forces of trench backfill at the Contractor's expense.

Delete Section 02221.3.3.E.2 and replace with the following.

2. Remove and replace all pavement damaged during construction by the Contractor's equipment, or the use thereof, to at least a depth of 1 inch (25 mm). Patches will not be allowed less than 1 inch (25 mm) in thickness.

Add Sections 02221.3.3.E.3 and 4.

3. Replace all asphalt pavement damaged during construction outside of restoration pay limits in conjunction with asphalt restoration and as otherwise required by the Engineer. Provide asphalt meeting the requirements of Section 02510: Asphalt Concrete Pavement, and place asphalt to produce a final surface uniform in texture and consistent with the line and grade of adjacent pavement or as directed by Engineer. No compensation will be allowed for removal and replacement of damaged pavement outside of the pay limits for asphalt restoration.

4. Assure work and materials for pavement restoration is in accordance with Section 02510: Asphalt Concrete Pavement.

Delete Section 02221.3.4.A and replace with the following.

A. General

1. Furnish all necessary labor, equipment, and incidentals necessary to dewater the project site during construction.

2. Keep all excavation dry and free from water during construction and the placement of materials. Do not place pipe, bedding, or backfill materials below the groundwater elevation established by dewatering operations. Do not allow ground water or stormwater to enter or flow through the underground piping during installation.

3. The cost of dewatering operations will be incidental to the cost of pipeline and appurtenance installation and no additional payment will be made for dewatering. Consider shifts in the groundwater level caused by changing seasons or local conditions in estimating the cost of dewatering operations, as no additional payments will be made for fluctuating groundwater levels.

4. Protect all structures that could be potentially impacted by dewatering operations. Repair any damage to structures caused as a result of dewatering at Contractor's expense.

Add Section 02221.3.4.B.

B. Discharge

1. Do not discharge or dispose of water from dewatering operations in such a manner as to flood existing landscaped areas, graveled areas, or structures unless approved by Engineer. Written permission from the appropriate landowner shall also be required for discharge or disposal on private property.

2. It is the Contractor's responsibility to comply with requirements and regulations of federal, state, and local agencies that govern areas affected by dewatering of the construction site and application for, and maintenance of, any required permits.

Add Sections 02221.3.6.A.2 and 3.

2. Storage of all imported backfill materials, including protecting said materials from adverse conditions that would disqualify them from use under these specifications, is the responsibility of the Contractor.

Delete Sections 02221.3.6.B.1.a and b and replace with the following.

a. Place Type 1 Pipe Bedding material 4 inches (10 cm) under, around the pipe, and to a point 6 inches (15 cm) above the top of the pipe in 6 inch (15 cm) lifts, using hand or other compaction methods without damaging or disturbing the pipe including mains and service lines and all appurtenances.

b. Place bedding material in equal lifts on both sides of the pipe for the full trench width. Thoroughly compact each lift of pipe bedding by tamping,

vibration, slicing with a shovel, rodding, or by a combination of these methods. Take special care to assure complete compaction under the haunches of the pipe.

Delete Section 02221.3.6.B.2 in its entirety.

Delete Section 02221.3.6.C.1 and replace with the following.

1. After the pipe bedding materials are placed and compacted as specified, backfill the trench.

   a. Use backfill material free of cinders, ash, refuse, organic or frozen material, boulders, or other deleterious material.

   b. From the top of the Type 1 Bedding to 6 inches (15 cm) below the ground surface, or the subgrade elevation, material containing stone up to 8 inches (20 cm) in the greatest dimension may be used.

   c. Cost of screening, drying, or moistening excavated backfill to comply with specifications will be considered incidental to the Contractor's bid price per linear foot of pipe and service lines, and unit prices for appurtenances, and no additional payment will be made for such work.

Delete Sections 02221.3.6.C.6.a through c and replace with the following.

a. Type A Trench Backfill. Place trench backfill in maximum 8 inch (20 cm) compacted lifts within 3 percent of optimum moisture content and compact to at least 95 percent of maximum dry density determined by AASHTO T99 or by ASTM D698. For materials that do not exhibit a typical well-defined moisture-density curve, compact backfill to 70 percent relative density as determined by ASTM D4253 and D4254.

b. Type B Trench Backfill. Place trench backfill in maximum 8 inch (20 cm) compacted lifts within 3 percent of optimum moisture content, and compact to at least 90 percent of maximum dry density determined by AASHTO T99 or by ASTM D698. For materials that do not exhibit a typical well-defined moisture-density curve, compact backfill to 50 percent relative density as determined by ASTM D4253 and D4254.

c. Type C Trench Backfill. Place and compact Type C Trench Backfill in maximum 12 inch (30 cm) lifts at densities equal to or greater than the densities of adjoining undisturbed soil. Mound earth over the trench top, if so directed by the Engineer. In cultivated areas, place stripped topsoil uniformly over the backfilled trench to the original depth. Do not compact the topsoil, but grade to provide a smooth surface conforming to the adjoining ground surfaces.

Delete Section 02221.3.6.D and replace with the following.

D. Replacement of Unsuitable Backfill Material

1. Remove and dispose of excavated soils that are saturated, contain deleterious materials, or have characteristics that, in the opinion of the Engineer, render the soils unsuitable as backfill, or which cannot be readily conditioned or dried to be made suitable.

2. Replace unsuitable soils with material obtained from trench excavations within the project limits at the expense of the Contractor. If suitable replacement material is not available within project limits, obtain material from an approved borrow source, to be paid for as Imported Backfill Material.

3. Provide imported backfill material with a gradation as follows and a maximum plasticity index of 10, determined by AASHTO T89 and T90 or by ASTM D4318. Imported backfill may not contain rock measuring greater than 6 inches (15 cm) in the greatest dimension.

Percent by Weight Passing	
Sieve Size	% Passing
1" (25 mm)	70 -100
No. 4 (4.75 mm)	40 - 80
No. 10 (2.00 mm)	25 - 60
No. 200 (0.075 mm)	2 - 35

4. Place and compact all imported material according to the applicable backfill specification requirements.

Delete Section 02221.3.6.F.1 and replace with the following.

1. Provide warning tape as described in this Section. Bury tape a maximum of 18 inches (45 cm) below finish surface grade.

Add Section 02221.3.8.B.

B. Dispose of vegetation; coarse debris resulting from pavement or sidewalk removal; stones, junk, debris, and other materials encountered in excavation work; and other similar waste materials away from the site of the work at the Contractor's expense.

Delete Section 02221.3.9.C and replace with the following.

C. The maximum permissible distance between backfilling/compaction operations and the end of newly installed pipe is 100 feet (30 m) in existing streets (and/or alleys) and 200 feet (60 m) in all other areas.

Delete Section 02221.3.9.E. and replace with the following.

E. For each work group consisting of a trench excavator, a pipe laying crew, and a backfilling/compaction crew, the maximum allowable open ditch at any time is 200 feet (60 m) in existing streets (and/or alleys) and 400 feet (120 m) in all other areas.

Add Section 02221.3.9.G.

G. At the completion of each working day, fill all trenches and/or provide safety netting, Jersey barrier, and other barricades required for public safety.

Add Section 02221.3.10.

3.10 DRAINAGE CROSSINGS

A. Where trenches are constructed in or across roadway ditches or other water courses, protect the backfill from surface erosion by adequate means. Where the grade of the ditch exceeds 1 percent, prevent erosion by a suitable method approved by the Engineer. Backfill trenches in such a manner that water will not accumulate in unfilled or partially filled trenches.

B. Remove all material deposited in roadway ditches or other water courses crossed by the trench immediately after backfilling is completed and restore the section, grades, and contours of such ditches or water courses to their original conditions, in order that the surface drainage is obstructed no longer than necessary.

SM-02230 STREET EXCAVATION, BACKFILL, AND COMPACTION

Delete Section 02230.1.3.A and replace with the following.

A. Field Density Testing

1. Meet the testing requirements of Special Provisions and Section 01400: Contractor Quality Control and Owner Quality Assurance.

2. Assure in-place field density tests meet ASTM D1556 (AASHTO T191) Sand Cone Method or ASTM D2922 and D3017 (AASHTO T238 and T239) Nuclear Densometer Methods. Quality assurance field density testing frequency is at the Engineer's discretion.

Delete Section 02230.3.1.A and replace with the following.

A. Perform Clearing and grubbing including the excavation, removal and disposal of roots, stumps, sod, or any organic material and buried debris from within construction limits. Construction limits are defined by all areas within the cut/fill limits and extending 1 foot (0.3 m) beyond the back of sidewalk and/or curb and gutter, or 2 feet (0.6 m) beyond the edge of pavement if no sidewalk or curb and gutter is present. Remove unsuitable material to at least 12 inches (30 cm) below subgrade elevation.

Delete Section 02230.3.4.A and replace with the following.

A. Excavate to the specified lines and grade or as directed by Engineer. Excavate without causing rutting, pumping, or other disturbances to underlying materials.

SM-02234 SUB BASE COURSE

Delete Section 02234.2.5.A and replace with the following.

A. Use water from an approved source.

SM-02235 CRUSHED BASE COURSE

Delete Section 02235.2.2.C and replace with the following:

C. Crush material so that the percentage of fractured particles in the finished product is as constant and uniform as practical. Crush to produce material where at least 50 percent of the material retained on the No. 4 sieve has at least one fractured face.

Delete Section 02235.2.4.A and replace with the following.

A. Use water from an approved source.

SM-02502 ASPHALT PRIME AND/OR TACK COAT

Delete Section 02502.2.1.A and replace with the following:

A. Unless otherwise specified, furnish asphalt material grade and typed as specified below.

1. Furnish Liquid Asphalt, MC-70 meeting the requirement of Section 702 of the MDT Standard Specifications for all asphalt prime coat applications.

2. Furnish Liquid Asphalt, MC-800 and/or MC-3000 meeting the requirement of Section 702 of the MDT Standard Specifications for all chip seal applications on gravel roads.

3. Furnish Emulsified Asphalt, SS-1 meeting the requirements of Table 1 in this section for all asphalt tack coat applications.

4. Furnish Emulsified Asphalt, CRS-2 or CRS-2P meeting the requirements of Table 2 in this section for all asphalt chip seal applications.

Add the following to Section 02502.3.2.B:

A. Apply MC-70 at a rate of 0.20 gallons per square yard (0.91 L/m^2) on all asphalt prime coat applications.

SM-02504 ASPHALT SEAL COAT

Add the following to Section 02504.2.2.A:

A. Unless otherwise specified, furnish ½ inch (13 mm) seal coat aggregate meeting the requirements of Section 2510: Asphalt Concrete Pavement and Table 1 in this section for all chip seal applications on gravel roads. Unless otherwise specified, furnish $^3/_8$ inch

(9.5 mm) seal coat aggregate meeting the requirements of Section 2510: Asphalt Concrete Pavement and Table 2 for all chip seal applications on asphalt roads.

Add the following to Section 02504.3.3.B:

2. Do not perform seal coat work if the local weather forecast includes a predicted temperature lower than 45 degrees Fahrenheit (7° C) within 12 hours after the intended close of the work for the day.

3. Do not perform seal coat work if the local weather forecast includes a probability of precipitation greater than 45 percent within the intended schedule of operations for the day. Regardless of the weather forecast, seal coat work may be suspended if impending adverse weather conditions occur in the vicinity of the work.

Delete Section 02504.3.3.D.1 and add the following:

1. Apply asphalt material at a rate of 0.35 gallons per square yard (1.6 L/m^2) when using Emulsified Asphalt CRS-2 or CRS-2P, and at a rate of 0.50 (2.3 L/m^2) gallons per square yard when using Liquid Asphalt MC-800 or MC-3000. Apply asphalt material at a rate of 0.20 gallons per square yard (0.9 L/m^2) for sand seal applications. Apply the asphalt material uniformly at the rate specified.

Delete Section 02504.3.3.E.1 and add the following:

1. Apply seal coat material at a rate of 25 pounds per square yard (13.6 kg/m^2) on all chip seal applications. Apply seal coat material at a rate of 15 pounds per square yard (8.1 kg/m^2) on all sand seal applications. During the course of the work, make adjustments in the rate of application as required or as directed by the Engineer.

SM-02510 ASPHALT CONCRETE PAVEMENT

Delete Section 02510.2.1.B and C and replace with the following.

B. Unless otherwise specified, furnish Type B or B-Modified aggregate meeting the requirements of Table 2 in this section for all asphalt pavement applications.

C. Unless otherwise specified, furnish (PGAB) PG58-28 Asphalt Binder Material meeting the requirements of Table 3 in this section for all asphalt pavement applications.

Delete Section 02510.2.2.H and replace with the following.

H. Produce coarse aggregate retained on the No. 4 sieve (4.75 mm) having a minimum of 75 percent by weight of particles with at least two mechanically fractured faces. When fractures are contiguous, assure the angle between the fracture planes is at least 30 degrees to count as two fractured faces.

Add the following to Table 2 in Section 02510.2.2.L.1.

Percent by Weight Passing	
Sieve Size	Type B-Modified
1" (25 mm)	---
3/4" (19 mm)	100
1/2" (12.5 mm)	82 - 95
3/8" (9.5 mm)	70 - 90
No. 4 (4.75 mm)	45 - 65
No. 10 (2.00 mm)	32 - 45
No. 40 (0.425 mm)	15 - 25
No. 200 (0.075 mm)	4 - 8

Add the following to Section 02510.2.5.B.2:

All type B-modified asphaltic concrete surfacing shall meet the following Marshall Design criteria as determined by ASTM D1559.

a. Number of Compaction Blows, Each End of Specimen 75

b. Stability, Minimum ..... 1500 lbs.

c. Flow ..... 8 – 16

d. Air Voids, Percent ..... 3 % - 5%

e. Percent Air Voids Filled with Bitumen 65-75

Add the following to Section 02510.3.14.B.3:

d. Skin patching will not generally be considered a satisfactory method of repair.

e. Tack coat all existing edges prior to placing new asphalt concrete.

Delete Section 02510.3.9 and replace with the following.

A. Sampling and testing of the aggregates and other constituent materials will meet the requirements of Special Provisions and Section 01400: Contractor Quality Control and Owner Quality Assurance.

Delete Section 02510.3.16.A.1 and add the following:

1. The maximum lift thickness is 3 inches (compacted depth) for surface courses and 6 inches (compacted depth) for base courses.

Delete Section 02510.3.29 and replace with the following.

3.29 PAVEMENT AND MATERIAL TESTING REQUIREMENTS

A. Meet the testing requirements of the Special Provisions and Section 01400: Contractor Quality Control and Owner Quality Assurance.

B. Owner or Owner's representative may perform field density testing of the pavement through the use of a nuclear densometer and/or by providing 4 inch diameter core samples of the asphalt surface courses.

C. The Owner or Owner's representative may determine the field thickness of the pavement by inserting a flat blade through the material to the previously placed base, measuring core samples, or other approved method. The actual measured thickness must be within ¼ inch (6.35 mm) of the specified thickness. When the measurement of any field thickness is less than the plan thickness by more than the allowable deviation, the actual thickness of the pavement in this area may be determined by taking additional measurements at intervals parallel to the centerline in each direction from the affected locations until, in each direction, pavement is found which is not deficient by more than the allowable deviation. Additional measurements of field thickness are considered as re-testing of failing areas.

D. In all cases, the costs of the following tests are at Contractor's expense:

1. Initial Aggregate Tests

2. Job Mix Formula

3. Any Tests Contractor Requires for Quality Control for Crushing, Screening, or Other Construction Operations

4. Re-testing of Failing Tests or Required Additional Testing

E. Correct all pavement composition and field density deficiencies at Contractor's expense. Areas found deficient in thickness by more than the allowable deviation will be evaluated by the Engineer. If the Engineer determines the deficient areas warrant removal, remove and replace the areas with asphaltic concrete of the thickness shown on the Drawings at the Contractor's expense.

SM-02528 CONCRETE CURB AND GUTTER

Delete Section 02528.2.3.A and replace with the following.

A. Furnish pre-formed expansion joint material meeting the requirements of AASHTO M213.

Add Section 02528.2.5.A.2.

2. Apply liquid membrane-forming compound between April 15 and August 14 of each year.

Add Section 02528.2.5.B.2.

2. Apply water-soluble or emulsified linseed oil compound between August 15 and April 14 of each year.

Delete Section 02528.3.2.B and replace with the following.

B. Complete excavation to the lines shown in the Contract Documents, or as specified by Engineer.

Delete Section 02528.3.4.A and replace with the following.

A. Place reinforcement as required by Contract Documents or Engineer's direction. Place and hold in position before placing concrete.

Delete Section 02528.3.6.B.1 and replace with the following.

1. Finish the surface of the concrete curbs and gutters true to the lines and grades shown on the Drawings. Work concrete until the coarse aggregate is forced down into the body of the concrete and no coarse aggregate is exposed.

Delete Section 02528.3.9.A and replace with the following:

A. Complete the curb backfill to 4 inches (10 cm) below the top of curb before final grading the subgrade and placing the base course of the street section.

Delete Section 02528.3.9.E and replace with the following.

E. Compact backfill to prevent settlement and level the surface to be free draining. Complete all backfill within 4 days after curb and gutter is placed.

SM-02529 CONCRETE SIDEWALKS, DRIVEWAYS, APPROACHES, CURB TURN FILLETS, VALLEY GUTTERS, AND MISCELLANEOUS NEW CONCRETE CONSTRUCTION

Delete Standard Drawing 02529-6, Retrofit Drive Approach, from the list in Section 02529.1.2.A and the drawing itself in its entirety from Appendix A.

Delete Sections 02529.3.2.A and B and replace with the following.

A. Excavate to the specified depth, or as directed by the Engineer. Assure the concrete subgrade has a firm and even surface and is compacted as specified in Section 02230, as may be modified by the Standard Modifications.

B. Place and compact at least 3 inches (75 mm) of gravel base material to a firm, even surface. This requirement is waived for concrete if it is to be installed on street base course material exceeding 3 inches (75 mm) or more in thickness and is approved by Engineer.

Delete Section 02529.3.4.A and replace with the following.

A. Place and hold in position reinforcement meeting the contract requirements, or as directed by Engineer, before placing the concrete.

Delete Section 02529.3.6.B.1 and replace with the following.

1. Finish the concrete surface true to lines and grades shown on the Drawings. Work concrete until the coarse aggregate is forced down into the body of the concrete and no coarse aggregate is exposed. Float the concrete surface using a magnesium float to a smooth and uniform surface. Plastering of the surface is prohibited. Edge all outside edges of the slab and all joints using a ¼ inch (6.4 mm) radius edging tool.

2. Immediately after the forms have been removed, remove all form bolts and tie wires to a depth of at least ½ inch (12.5 mm) below the surface of the concrete. Clean and fill all holes and depressions caused by the removal or setting back of form bolts or tie wires with Portland cement mortar composed of 1 part cement by volume and 2 parts sand. Chip out, clean and fill all rock pockets, honey, and air pockets with mortar, in compliance with instruction of the Engineer. If, in the judgment of the Engineer, rock pockets are of such an extent or character as to materially affect the strength of the structure or to endanger the life of the steel reinforcement, he may declare the concrete defective and order the complete removal and replacement of that portion of the structure so affected.

3. Carefully make all mortar patches using a very dry mortar tamped firmly in the void. Keep the patches wet for a period of 3 days after which it will be inspected for shrinkage cracks. Excessive cracking will require complete removal and replacement of the patch.

4. Screed, float and light broom finish sidewalks, exterior slabs, approaches, etc. and membrane cure. After concrete has hardened sufficiently, give the surface a broom finish. Obtain Engineer approval of the broom before use. Assure the broom strokes are square across the concrete from edge to edge, overlapping adjacent strokes. Broom without tearing the concrete. Assure the broomed finish produces regular corrugations not exceeding $^{1}/_{8}$ inch (3.2 mm) in depth.

5. Steel trowel finish interior floor surfaces which will be exposed after construction is completed, surfaces to be covered with resilient floor coverings or seamless floor coverings, the exposed portion of the top of equipment bases, the top of interior curbs, and other surfaces designated on the Drawings. Perform troweling after the second floating when the surface has hardened sufficiently to prevent an excess of fines from being drawn to the surface. Produce a dense, smooth, uniform surface free from blemishes and trowel marks.

6. Apply liquid or shake-on floor hardener to all interior concrete floors which are subject to foot or equipment traffic and are not required to be covered with resilient floor coverings or seamless flooring. Prior to application, thoroughly clean the floor of all dirt, grease, and other foreign matter. Do not apply curing compounds to floors scheduled to receive floor hardener unless compatibility with the hardener is demonstrated in manufacturer's data.

Delete Section 02529.3.9.C and replace with the following

C. Compact backfill to prevent settlement and level the surface to a neat appearing and free draining surface within 4 days after concrete is placed.

Delete Section 02529.3.11.A and replace with the following.

A. Construct new street monuments, new street light bases, and other miscellaneous concrete construction in accordance with the detail drawings, or as directed by Engineer.

Add Section 02529.3.11.B.

B. New concrete construction required to maintain or restore existing structures will be considered incidental to the cost of pipe installation and no additional payments made. Include the concrete costs associated with thrust blocks with the unit costs bid for the valve, fittings, or appurtenance requiring the thrust block. New concrete work not included above, or specifically called out on the Drawings, must first be approved by Engineer.

Add Section 02529.3.11.C.

C. Construct all curb ramps with detectable warning surfaces in conformance with the requirements of the Americans with Disabilities Act Accessibility Guidelines (ADAAG). Detectable warning surfaces shall be black. Detectable warning surfaces shall be considered deficient and subject to replacement by the Contractor if more than 5 percent of the truncated domes on a ramp surface are missing or damaged, if the detectable warning product has lost any adhesion to the concrete, or if the detectable warning product is cracked or shows other signs of distress, at the end of the two year warranty period.

SM-02660 WATER DISTRIBUTION

Add the following publications to the list in Section 02660.1.3.

ASTM F477	Elastomeric Seals (Gaskets) for Joining Plastic Pipe
AWWA C116	Protective Fusion-Bonded Epoxy Coatings for the Interior and Exterior Surfaces of Ductile-Iron and Gray-Iron Fittings for Water Supply Services
AWWA C502	Dry-Barrel Fire Hydrants
AWWA C600	Installation of Ductile-Iron Water Main and Their Appurtenances

In Section 02660.1.4, delete the reference to Standard Drawings 02660-2: Water and Sewer Main Separation, 02660-4: Fire Hydrant Setting, and 02660-6: Water Service Line and refer to the attached Modified Standard Drawings 02660-2, 02660-4, and 02660-6.

Delete Sections 02660.2.2.B.1 and 2 and replace with the following.

1. Furnish Class 52 wall thickness meeting AWWA C151, American National Standard for Ductile Iron Pipe for Water.

Add Section 02660.2.2.B.5.b and c.

b. Restrained joint systems and mechanical restrained joint fittings shall be installed where specifically indicated in the Drawings. Restrained joints

may also be allowed in applications not specifically identified in the Drawings in lieu of concrete thrust blocks with Engineer approval.

1) Furnish restrained joint systems as manufactured by US Pipe (Field Lok 350 Gaskets), American Pipe (Fast-Grip Gaskets), or an approved equivalent.

2) Provide mechanical restrained joint fitting constructed of ductile iron and conforming to the material and performance requirements of AWWA C153. Assure all mechanical restrained joint fittings have seals conforming to ASTM F477 and the physical testing requirements of AWWA C111. Provide mechanical restrained joint fittings coated with fusion bonded epoxy coatings meeting the requirements of AWWA C116. Install all restrained joints in full conformance with manufacturer's recommendation, and assure the assembly of fitting joints does require beveling of the plain end of a cut pipe or the use of jacks or power equipment to force the pipe end past the gasket. Furnish mechanically restrained joint fittings as manufactured by One Bolt, Inc. (OneBolt), EBAA Iron, Inc. (Mega-Lug mechanical joint restraint), or an approved equivalent.

Add Sections 02660.2.2.B.6.b and c.

b. Field verify material type and size to ensure that couplings will be sized for appropriate material and size.

c. Furnish type (1) above coupling as manufactured by Romac Industries, Dresser Piping Specialties, or an approved equivalent.

Delete Section 02660.2.2.D Concrete Cylinder Pipe in its entirety

Delete Section 2.2.E.1.a. and replace with the following.

a. Furnish service pipe of the size or sizes specified. If not specified, match the size of existing service lines being connected to or replaced. Service lines are considered 2 inch (50 mm) size and under. Service lines over 2 inch (50 mm) size are considered as water mains and are specified under the applicable sections.

Add Section 02660.2.2.E.c.2 and 3.

2) Assure all new copper service pipes are continuous and free of joints from the corporation stop to the curb box unless otherwise approved by Engineer.

3) For all copper service pipe, assure corporation stops, curb stops, couplings, and all other fittings have compression connection as manufactured by Mueller (110 Compression Connection Series),

Ford (Quick Joint Connection Series), A.Y. McDonald (McQuick Compression-Q Series), or an approved equivalent.

Add Section 02660.2.2.E.d.2.

2) For all polyethylene service pipe, assure corporation stops, curb stops, couplings, and all other fittings have pressure connections designed specifically for polyethylene pipe as manufactured by Mueller (Insta-Tite Connection Series) or an approved equivalent..

Add Section 02660.2.3.B.

B. Furnish sleeve (1) above as manufactured by Mueller, Rockwell, Dresser, or an approved equivalent. Provide thrust blocking behind tee flow-through sized per thrust block detail in the drawings. Furnish type (2) above as manufactured by Smith-Blair (Model 622), Ford (FTS), or an approved equivalent.

Delete Section 02660.2.4 through 7 and replace with the following.

2.4 CORPORATION STOPS

A. Furnish brass corporation stops with inlet end to meet tapping requirements and outlet with compression coupling for copper tubing or pressure coupling for polyethylene tubing.

2.5 SERVICE CLAMPS

A. Provide service clamps, where required, that are flat, double strap, ductile iron bodied and that have a nylon coating and standard AWWA corporation stop threads. Assure service clamps meet all applicable parts of AWWA C800.

B. Assure service clamps for PVC pipe provide full support around the pipe circumference with a bearing area of sufficient width along the pipe axis, 2 inch (50 mm) minimum, to insure the pipe will not be distorted when the saddle is tightened. Service clamps for PVC pipe, where required, shall be stainless steel full circumference bands with corporation stop threads.

2.7 CURB BOXES

A. Provide extension type curb boxes having at least a 6.5 foot (1.98 m) extended length and a range between the extended length and retracted length that allows for the curb box to be installed absolutely flush with the sidewalk or finished grade.

B. Furnish curb boxes as manufactured by Ford (EM2-xx-56 or EM2-xx-57 Series), Mueller (H-10300 Series or H-10380 Series), A.Y. McDonald (5614 or 5615), or an approved equivalent.

Delete Section 02660.2.8.A.1 and replace with the following.

1. Unless designated otherwise, valves 12 inches (30 cm) in diameter or smaller will be gate valves. Furnish iron body gate valves or resilient seat gate valves

with non-rising stems with design, construction, and pressure rating meeting AWWA C509 and the following requirements.

Add Section 02660.2.8.A.4.

4. Furnish resilient seat gate valves as manufactured by Mueller, Clow, American Darling, or an approved equivalent.

Delete Section 02660.2.8.B and replace with the following.

B. Butterfly Valves

1. Unless designated otherwise, all valves larger than a 12 inch (30 cm) diameter will be butterfly valves. Furnish Class 150, rubber seated, butterfly valves for water distribution systems meeting AWWA C504 requirements. Valves are to be equipped with push-on ends and lubricated screw type operators designed for underground service.

2. Rubber valve seats to be replaceable without disassembling the valve and not interrupted by the shafting. Rubber seats may be retained on the disc edge by stainless steel clamping instead of bonding to the valve body. Assure shaft packing is the self-adjusting, permanent type.

3. Assure underground service operators are permanently lubricated, screw type, totally enclosed and watertight constructed. Assure overload protection is incorporated in the operator allowing 450 foot pounds (610 J) input torque at full-open and full-closed positions without damaging the operator or valve. Install valves with the operating mechanism oriented on either the south or west side of the pipeline.

4. Provide a 2 inch (50 mm) square operating nut and valve box for operating the valve. Valves to open counter clockwise. Furnish bonnet and gland bolts and nuts either fabricated from low-alloy steel for corrosion resistance or electroplated with zinc or cadmium. The hot-dip process in accordance with ASTM A153 is not acceptable.

5. Evenly coat all exterior ferrous surfaces, except the flange faces, with black asphalt varnish in accordance with Section 5.3 of AWWA C509, or epoxy in accordance with AWWA C550. Evenly coat with epoxy all wetted ferrous surfaces in accordance with AWWA C550. Apply epoxy coating to a minimum uniform 4 mil thickness.

6. Furnish performance certification, leakage and hydrostatic tests as specified in AWWA C504. Assure valve manufacturer has at least 5 years experience manufacturing waterworks and distribution valves.

7. Furnish butterfly valves as manufactured by Dresser Industries (450 Valve), Allis-Chalmer (Streamseal), Henry Pratt (Groundhog), or an approved equivalent.

Add Sections 02660.2.14 through 2.17.

2.14 WATER MAIN INSULATION

A. Furnish extruded polystyrene rigid foam insulation conforming to ASTM C578, Type IV, with a minimum thermal resistance (R value) of 5.0 per 1 inch of thickness at 75° Fahrenheit mean temperature. Water absorption for the insulation shall not exceed 0.10 by volume as measured by ASTM C272.

B. Materials shall be delivered in their original unopened units, stored off the ground, protected from direct sunlight with a light-colored opaque polyethylene film and ventilated to prevent excessive temperature. Damaged or deteriorated materials shall be removed from the premises.

C. Furnish extruded polystyrene rigid foam insulation as manufactured by Dow Chemical Company (Styrofoam Freezermate), Owens-Corning (Foamular 250), or an approved equivalent.

2.15 FLUSHING HYDRANTS

A. Furnish hidden type flushing hydrants with a dry barrel design and a 2½ inch (63 cm) hose connection with National Standard hose threads for 6.5 foot (2 m) minimum bury.

B. Furnish flushing hydrants complete with shut-off valves with a closed-bottom body, tee head key, and an integral drain to allow hydrant post to drain after use to prevent freeze damage.

C. Furnish a meter box with a minimum width of 18 inches (50 cm) and a minimum depth of 24 inches (60 cm) and a locking lid to house the hydrant outlet.

D. Paint any portions of the flushing hydrant above the ground line to meet the Owner's standard.

E. Furnish flushing hydrants as manufactured by The Kupferle Foundry Company (MainGuard No. 78, Underground Model) or an approved equivalent.

2.16. YARD HYDRANTS

A. Provide frost-proof yard hydrants designed for a minimum operating pressure of 100 pounds per square inch (689 kPa) and a minimum bury depth of 6.5 feet (2 m).

B. Furnish yard hydrants complete with brass hydrant ells and tees, a brass vacuum breaker, an anti-siphon outlet, and integral drain that allows hydrant barrel to drain after use to prevent freeze damage.

C. Provide a set of spare parts per each two yard hydrants installed that are manufactured by the same manufacturer as the yard hydrants and specific to the model of yard hydrant.

D. Assure hydrants are equipped with an integral locking eyehole for the placement of a padlock. Provide a padlock compatible with the yard hydrants with each hydrant installed. Assure all locks provided are keyed alike and provide at least two sets of keys for the padlocks.

E. Furnish yard hydrants as manufactured by Merrill (Model C-1000 with Spare Parts Kit C) or an approved equivalent.

2.17 BLOWOFF HYDRANTS

A. Provide 2 inch (50 mm) diameter post type blowoff hydrants meeting all applicable parts of AWWA C502.

B. Furnish blowoff hydrants with a dry barrel design, a compression type main valve, and dual bronze drain valves.

C. Assure blowoff hydrants are rated for 150 pounds per square inch (1,034 kPa) maximum working pressure and 300 pounds per square inch (2,068 kPa) test pressure.

Delete Sections 02660.3.2.A.3 and 4 and replace with the following.

3. Store all material safely and to prevent damage. Keep pipe interior and other accessories free from dirt and foreign matter at all times. If pipe is stored on site out of doors for more than 7 days, keep ends of pipe sealed against rodent intrusion and cover PVC pipe with protection from ultraviolet radiation from the sun.

4. Deliver and distribute all Contractor furnished pipe at the site. Load and unload pipe, fittings, specials, valves, and accessories to prevent damage. Do not permit pipe handled on skidways to skid or roll against pipe already on the ground. Do not make metal-to-metal contact between pipes or between fittings when moving or in storage, but rather use non-metal materials such as fire-hose. Do not drop pipe under any circumstance.

Delete Sections 02660.3.2.C.3 in its entirety.

Delete Sections 02660.3.2.C.7 and 8 and replace with the following.

7. Long radius curves, either horizontal or vertical, may be laid with ductile iron pipe using deflections at the joints when shown on the Drawings. Deflection at the joints is not to exceed 50 percent of manufacturer's recommended maximum deflection. PVC pipe may be deflected over the length of the pipe or at fittings when shown on the Drawings, based upon manufacturer's recommendations. The Contractor shall provide the Engineer all manufacturers' deflection requirements and warranty information that specifically states that deflection of pipe and fittings does not reduce or eliminate warranty coverage or pressure and safety ratings.

8. No additional payment will be made for laying pipe on planned curves, nor for field changes involving standard pipe lengths deflected at the joints or over the length of the pipe.

Add Section 02660.3.2.C.12.

12. Provide vertical fittings with thrust blocks one and a half times the sizes set forth in Standard Drawing 02660-1 and include 2 #5 rebar anchors bent around each fitting and set into the concrete.

Add Section 02660.3.3.B:

B. Polyethylene encasement installation shall be per the Ductile Iron Pipe Research Association (DIPRA) Polyethylene Encasement Installation Guide.

Delete Section 02660.3.4.A.1 and replace with the following.

1. Perform hydrostatic and leakage testing in accordance with AWWA C600. Once the pipe is laid and backfilled, test for at least 2 hours, all newly laid pipe, or any valved section, at the highest point along the test section. Test to a hydrostatic pressure 2.0 times the normal operating pressure at the test point, but in no case less than a minimum gage pressure of 125 pounds per square inch (931 kPa) or greater than the pressure rating of the pipe being tested. Do not test more than 1,000 linear feet (305 m) of pipeline at one time, unless otherwise approved by the Engineer.

Delete Section 02660.3.4.B.1 and replace with the following.

1. Before chlorination, flush the mains thoroughly after the pressure and leakage test are completed. Contractor is responsible for all permits, as may be required, associated with cleaning water mains and the entire disinfection process.

Delete Section 02660.3.4.C.2.a.3 in its entirety.

Delete Section 02660.3.4.C.3.a and replace with the following.

a. Two (2) methods of chlorination may be used. The continuous feed method gives a 24 hour chlorine residual of not less than 25 parts per million (25 mg/L), and the slug method provides a 3 hour exposure of not less than 50 parts per million (50 mg/L) free chlorine.

Delete Section 02660.3.4.C.3.a.1 in its entirety.

Delete Section 02660.3.4.C.3.a.2.b and replace with the following.

b) Use water from the existing distribution system or other approved source of supply to flow at a constant, measured rate in to the newly laid water main. At a point not more than 10 feet (3 m) downstream from the beginning of the new main, assure water entering the new main receives a dose of chlorine fed at a constant rate such that the water will have at least 50 parts per million (50 mg/L) free chlorine. To assure that this concentration is provided, measure the chlorine concentration at regular intervals.

Delete Section 02660.3.4.C.3.a.2.d and replace with the following.

d) During chlorine application, position valves so that the chlorine solution in the main being treated does not flow into water mains in active service. Do not stop chlorine application until the entire main is filled with chlorinated water. Retain the chlorinated water in the main for at least 24 hours, operating all valves and hydrants in the section treated to disinfect the appurtenances. At the end of the 24 hour period, the treated water in all portions of the main must have a minimum free chlorine residual of 25 parts per million (25 mg/L).

Delete Section 02660.3.4.D.1 and replace with the following.

1. After final flushing and before the water main is placed in service, test a sample, or samples, collected from the main(s) for turbidity and bacteriological quality. Collect at least one sample from the new main and one from each branch. Collect the samples and have the tests performed at an approved laboratory.

Add Section 026603.6.B.1.

1. Install gate valve boxes such that the tops are 3 inches (76 mm) below the finished grade in aggregate surfaced areas and at finished grade in asphalt surfaced areas. In unsurfaced areas, leave the top of gate valve boxes 6 inches (152 mm) above the existing grade and slope backfill to the top at a 4:1 slope.

Delete Section 02660.3.6.C.1 replace with the following.

1. For clarity thrust blocks have not been shown on Drawings, but install each valve with thrust blocking and anchor rods per the details in the Drawings.

Delete Section 02660.3.7 and replace with the following.

A. Set all hydrants plumb with the pumper nozzle facing the street. Set the hydrant with the ground line at the location indicated by the hydrant manufacturer. Assure 1 to 2 inches (25 to 50 mm) of clearance between the existing ground or sidewalk and the bolt bottom on the hydrant bottom flange. Verify depth and riser length to establish clearance within 1 inch (25 mm) tolerance.

B. Provide drainage at the hydrant base by placing clean gravel under and around it. Place gravel at least 12 inches (30 cm) on all sides from the base of the hydrant to at least 6 inches (15 cm) above the drain opening. Brace the hydrant against unexcavated earth at the trench end with concrete backing as detailed on the Drawings. Furnish hydrants with the specified gate valves. The gate valve shall be located three feet from the hydrant unless otherwise staked in the field by the Engineer. Install hydrants in accordance with the detail provided in the Drawings, or as located in the field by the Engineer.

Add Section 026603.8.C

C. As the Contractor is constructing the new mains, he will be responsible for locating existing services. Locate new services in the same proximity as the existing services.

Delete Section 02660.3.9.B and replace with the following.

B. Provide water service clamps for all corporation stops. Set the saddle and corporation stop on the pipe prior to tapping and make the tap through the corporation stop using a standard tapping machine only. Assure taps for water service saddles are full-size taps. Undersized taps will not be allowed. Perform tapping using an approved tapping machine using clean, sharp drill taps for DIP. Use shell cutters for tapping PVC pipe.

Add Sections 02660.3.10.A through C.

3.10 WATER MAIN INSULATION

A. Install insulation on the new water main when crossing under, over, or within six feet of culverts that are open to the air, or in cases where less than six feet of cover is provided. Install the insulation the full width of the trench excavation.

B. Place a 6 mil thick polyethylene sheeting over the insulation, lapping any joints a minimum of 12 inches (30 cm).

C. Place a 6 inch (15 cm) sand cushion above and below the insulation.

3.11 FLUSHING HYDRANTS

A. Set all flushing hydrants plumb with the hose connection orientated as directed by Owner. Set hydrants with the hose connection with the bury line as indicated by the hydrant manufacturer 8 inches (20 cm) below finished grade in the thermal shell. Install hydrants in accordance with the detail provided in the Drawings, or as specified by the Engineer.

B. Provide drainage at the flushing hydrant by placing clean gravel under and around it. Place gravel at least 12 inches (30 cm) on all sides from the base of the hydrant and shut-off valve to at least 6 inches (15 cm) above the drain opening.

3.12 YARD HYDRANTS

A. Set all yard hydrants plumb with the outlet orientated as directed by Owner. Assure hydrants have a finished height above the final grade between 30 and 36 inches (75 and 90 cm). Install hydrants in accordance with the detail provided in the Drawings, or as specified by the Engineer.

B. Provide drainage at the yard hydrant by placing clean gravel under and around it. Place gravel at least 12 inches (30 cm) on all sides from the base of the hydrant to at least 6 inches (15 cm) above the drain opening.

SM-02720 STORM DRAIN SYSTEMS

In Section 02720.1.4, delete the reference to Standard Drawings 02720-3: Sanitary Sewer and Storm Drain Manhole and refer to the attached Modified Standard Drawing 02720-3.

SM-02730 SANITARY SEWER COLLECTION SYSTEMS

Add the following publications to the list in Section 022730.1.3.

ASTM D5926	PVC Gaskets for DWV, Sewer, Sanitary, and Storm Plumbing Systems
ASTM C1173	Flexible Transition Couplings for Underground Piping Systems
AWWA C111	Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
AWWA C115	Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges
AWWA C151	Ductile-Iron Pipe, Centrifugally Cast, for Water or Other Liquids
AWWA C600	Installation of Ductile-Iron Water Mains and Their Appurtenances
CSA B602	Mechanical Couplings for Drain, Waste, Vent Pipe, and Sewer Pipe

In Section 02730.1.4, delete the reference to Standard Drawings 02660-2: Water and Sewer Main Separation and 02720-3: Sanitary Sewer and Storm Drain Manhole and refer to the attached Modified Standard Drawings 02660-2 and 02720-3

Add Section 02730.2.2.A.6.

6. Gravity Sewer Service Couplings

   a. Provide coupling with a 0.12 inch (3 mm) minimum thickness stainless steel shield and stainless steel clamps.

   b. Assure coupling gaskets meet material requirements of CSA B602, ASTM D5926, and ASTM C1173.

   c. Furnish coupling as manufactured by Fernco (Strong Back RC Series) or an approved equivalent.

Delete Sections 02730.2.2.C and D and replace with the following.

C. If HDPE pipe is included in the work, refer to the "High Density Polyethylene (HDPE) Pipe" technical specification.

D. Ductile Iron Pipe (DIP)

   1. General

      a. Furnish ductile iron pipe with a Class 52 wall thickness and a minimum operating pressure of 150 psi (10 Bar) that meets AWWA C151.

      b. Assure the pipe interior is coated with a fusion bonded epoxy, a 40 mil polyethylene liner, or another coating rated for wastewater applications, as approved by Engineer.

      c. Assure the outside pipe surface is coated with a minimum of 1 mil thickness of bituminous coal tar base coating.

      d. Polyethylene encasement installation shall be per the Ductile Iron Pipe Research Association (DIPRA) Polyethylene Encasement Installation Guide.

2. Pipe Jointing

a. For underground applications, assure joints are push-on joints or mechanical joints meeting AWWA C111.

b. For aboveground or submerged applications, assure joints are flanged joints meeting AWWA C115.

Add Section 02730.3.1.D.5.

5. Lay all pipe for gravity lines with the bell end of the pipe sections placed toward the uphill side of the slope.

Delete Section 02730.3.1.E.1 and replace with the following.

1. Install the pipe within ½ inch (13 mm) of the specified alignment and within ¼ inch (6 mm) of the specified grade for pipe 14 inches (35 cm) in diameter and smaller and within ½ inch (13 mm) of the specified grade for pipe greater than 14 inches (35 cm) in diameter. These tolerances will apply to any point along the entire length of the pipe. The following are minimum slopes that must be provided, unless specifically indicated otherwise on the Drawings:

Minimum Slope in Feet			
Sewer Size	Per 100 feet	Sewer Size	Per 100 feet
6 inch	0.60	21 inch	0.10
8 inch	0.40	24 inch	0.08
10 inch	0.28	27 inch	0.067
12 inch	0.22	30 inch	0.058
14 inch	0.17	33 inch	0.052
15 inch	0.15	36 inch	0.046
16 inch	0.14	39 inch	0.041
18 inch	0.12	42 inch	0.037

Add Section 02730.3.3.C.

C. Connect exiting services at closest possible point to the new main unless otherwise indicated on the Drawings or specified in the special provisions.

Delete Section 02730.3.4.D.3 and replace with the following.

3. The allowable infiltration or exfiltration, including manholes, cannot exceed 100 gallons per day per mile of sewer per inch of pipe diameter (92.5 Liters per day per kilometer of sewer per centimeter of pipe diameter). This does not exclude obvious and concentrated leaks and physical defects, such as open joints, pinched gaskets, cracked barrels or bells, etc. Make repairs on concentrated leaks and as required to reduce infiltration or exfiltration leakage below the specified rate.

Delete Sections 02730.3.4.E.4 and 5 and replace with the following.

4. Apply air slowly to the pipeline until the pressure reaches 4.0 pounds per square inchg (27.6 kPa). Throttle the air supply to maintain the internal pressure between 4.0 and 3.5 pounds per square inchg (27.6 and 24.1 kPa) for at least 2 minutes. During this time, check the plugs with soap solution to detect any plug leakage.

5. When the pressure reaches exactly 3.5 pounds per square inchg (24.1 kPa), disconnect the air supply, start a stopwatch, and record the time for the pressure to drop to 2.5 pounds per square inchg (17.2 kPa). The minimum time allowed for the pressure drop is computed on an air loss rate of 1.0 ft^3/min (1.7 m^3/min) or an air loss rate of 0.0015 ft^3/min per square foot (0.0275 m^3/min per square meter) of inner pipe surface area under test, whichever rate yields the least time for the pressure drop. Should the time of the pressure drop be less than the allowable specified time, make the necessary leakage repairs and repeat the air test.

Delete Sections 02730.3.4.E.7 and 8 in their entirety.

Delete Sections 02730.3.4.G.1 - 2 and replace with the following.

1. Before final acceptance, Owner will require all sewers to be inspected using a television camera after leakage tests. Dewatering equipment must be shut down a minimum of 24 hours prior to the television inspection to allow groundwater to return to typical levels. Adequately flush the sewer lines prior to each television inspection. Television inspection of dry sewer lines is not acceptable. A sewer line is deficient and unacceptable if (1) the alignment is outside the specified limits, (2) water ponds in any section are equal to or greater than 2 times the grade tolerances specified herein under Section 02730.3.E.1, or (3) the pipe has visible defects such as open joints, pinched gaskets, cracked barrels or bells, or similar defects. Correct any deficiencies and re-inspect using a television camera. Sanitary sewer service lines may be subject to the same television inspection requirements as sanitary sewer mains at the discretion of the Engineer and Owner.

2. As with all other testing, the cost for televising the sewer line for final acceptance will be considered incidental to the Contractor's bid price per lineal foot of pipe, and no additional payment will be made for such work. All costs incurred in any television inspection performed solely for the Contractor's benefit will be the responsibility of the Contractor.

Add Section 02730.3.4.J.

J. Hydrostatic and Leakage Testing for Force Mains

1. Perform hydrostatic and leakage testing in accordance with AWWA C600. Once the pipe is laid and backfilled, test for at least 2 hours, all newly laid pipe, or any valved section, at the highest point along the test section. Test to a hydrostatic pressure 2.0 times the normal operating pressure at the test point, but in no case

less than a minimum gage pressure of 125 pounds per square inch (931 kPa) or greater than the pressure rating of the pipe being tested.

2. Slowly fill the pipe with water, purging all air, and apply the test pressure using a pump hooked up so that the pressure and leakage can be measured. To purge the pipe of air during the test, it is necessary to tap the pipe at its highest points if permanent air vents are not located at the high points. Use corporation stops for this purpose. Furnish the pump connections, gauges, stops, and all necessary apparatus for testing.

3. Disassemble and reassemble all joints showing leakage after thorough cleaning. Remove and replace all cracked or defective pipes or fittings discovered during the pressure test with sound material and repeat the test.

4. Conduct the leakage test concurrent with the pressure test for 2 hours. Leakage is defined as the quantity of water supplied into the pipe, or any valved section thereof, necessary to maintain pressure within 5 pounds per square inch of the pressure test after the pipe has been filled with water and purged of air.

5. The pipe installation will be rejected if the leakage exceeds that determined by the following formula:

$$L = SD(P)^{1/2} \div 133{,}200$$

In which L equals the allowable leakage in gallons per hour; S is the length of pipe being tested, in feet; D is the nominal diameter of the pipe being tested, in inches; and P is the average test pressure during the leakage test, in pounds per square inch gauge.

Where the pipe being tested for leakage is thermally fused HDPE, the allowable leakage will be reduced to 25 percent of L, as calculated.

6. Should any test of pipe laid disclose leakage exceeding that specified above, locate and repair the defective joints until the leakage is within the specified allowance.

7. Conduct the pressure and leakage tests with the Engineer present.

SM-03210 REINFORCING STEEL

Delete Section 03210.2.1.A and replace with the following.

1. Furnish deformed reinforcement steel meeting ASTM A615, (AASHTO M31) or ASTM A705, Grade 60.

Delete Section 03210.3.3.A and replace with the following.

A. Accurately place and hold firm all steel reinforcement in the plan locations, or as directed by Engineer, as concrete is being placed. Thrusting dowels into freshly poured concrete is prohibited.

Delete Section 03210.3.3.C and replace with the following.

C. Overlap welded wire fabric for successive mats or rolls providing an overlap measured between outermost cross wires of each fabric sheet not less than the greatest spacing of the cross wires plus 2 inches (50 mm) but not less than 6 inches (150 mm), whichever is greater. Extend the fabric across supporting beams and walls to within 4 inches (100 mm) of concrete edges. It may extend through contraction joints. Adequately support the fabric during concrete placement to maintain its position in the slab using the methods previously described or by laying the fabric on a concrete layer of the required depth before placing the upper slab layer.

Delete Section 03210.3.3.G and replace with the following.

G. Follow the minimum concrete protective covering for reinforcement below, unless noted otherwise on the Drawings.

SM-03310 STRUCTURAL CONCRETE

Delete Section 03310.1.3.B and replace with the following.

B. Employ, at the Contractor's expense, a testing laboratory acceptable to the Engineer to perform material evaluation tests, the mix design prior to placing any concrete, and all acceptance testing during the onsite placement of the concrete. Retesting or additional testing of concrete or materials failing to meet the requirements of these specifications must be done by the Contractor at no additional cost to the Owner.

Amend the footnote for Table 2.2 in Section 03310.2.2.B.4 to read the following.

*Air content tolerance is plus two percent (+2%) to minus one percent (-1%).

Delete Section 03310.3.7.A.2.a and replace with the following.

a. During each day's pour, check the consistency of the concrete by slump test. Also perform a slump test each time a test cylinder is made. Assure slump tests meet ASTM C143 "Method of Test for the Slump of Portland Cement Concrete."

Delete Section 03310.3.7.A.3.h and replace with the following.

h. When concrete fails to meet the requirements above or when tests of field cured cylinders indicate deficiencies in protection and curing, the Contractor may order tests on the hardened concrete under Chapter 17.3 of ACI-301-84 or load tests in Chapter 20 of the ACI Building Code (ACI 318-83) for that portion of the structure where the questionable concrete has been placed. In the event the load or core tests also indicate that the structure is unsatisfactory, make all modifications as directed by the Engineer to make the structure sound.

Delete Section 03310.3.7.A.4.a and replace with the following.

a. During each strength test, check the air content by either ASTM C231 "Method of Test for Air Content of Freshly Mixed Concrete by the Pressure Method, ASTM C173 "Method of Test for Air Content of Freshly Mixed Concrete by the Volumetric Method", or ASTM C138 "Method of Test for Unit Weight, Yield, and Air Content (Gravimetric) of Concrete."

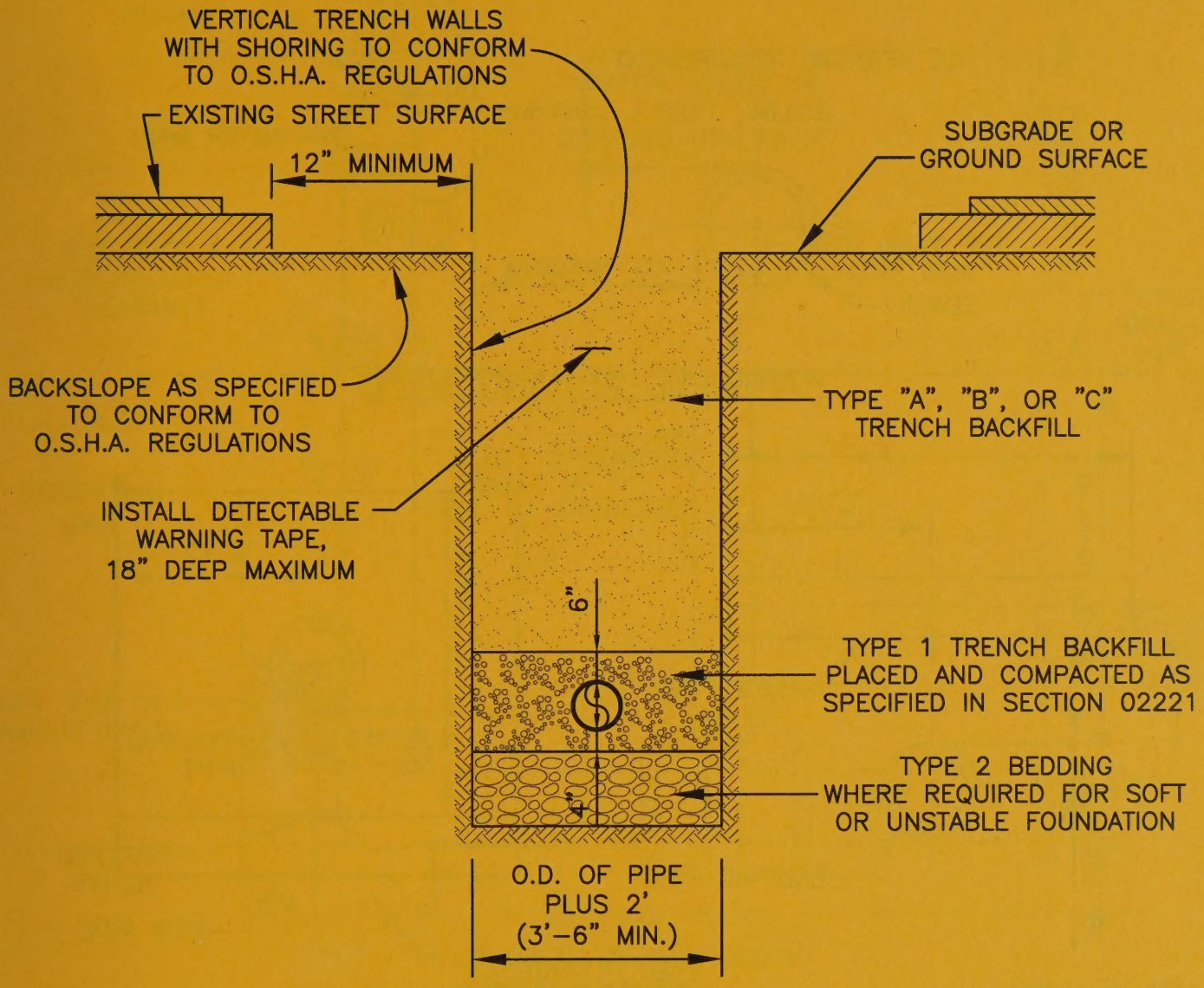
Add Sections 03310.4.2.A.2 and 3.

2. Concrete producers are to allow access to their facilities by Owner or Owner's representative for inspecting their facilities and/or sampling materials. Assure all facilities meet the requirements of the "National Ready-Mix Concrete Association" check list for concrete production facilities.

3. Items directly affecting a facility's ability to properly proportion, transport, and deliver concrete may be reason for disqualifying that facility as a source of supply until such deficiencies are corrected. Examples would include cement and aggregate scales that will not accurately weigh materials or mixer units which will not thoroughly mix concrete materials.

Amend the note for Table 4.1 in Section 03310.4.2.D to read the following.

Note: The monthly reports indicated above will not be required during non-production months. Frequency of submittals may change as dictated by variations of test data.

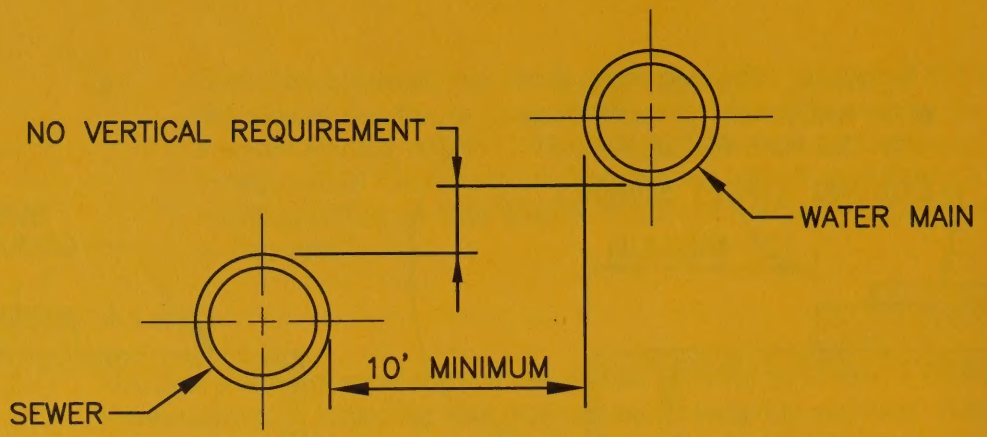


NOTES:

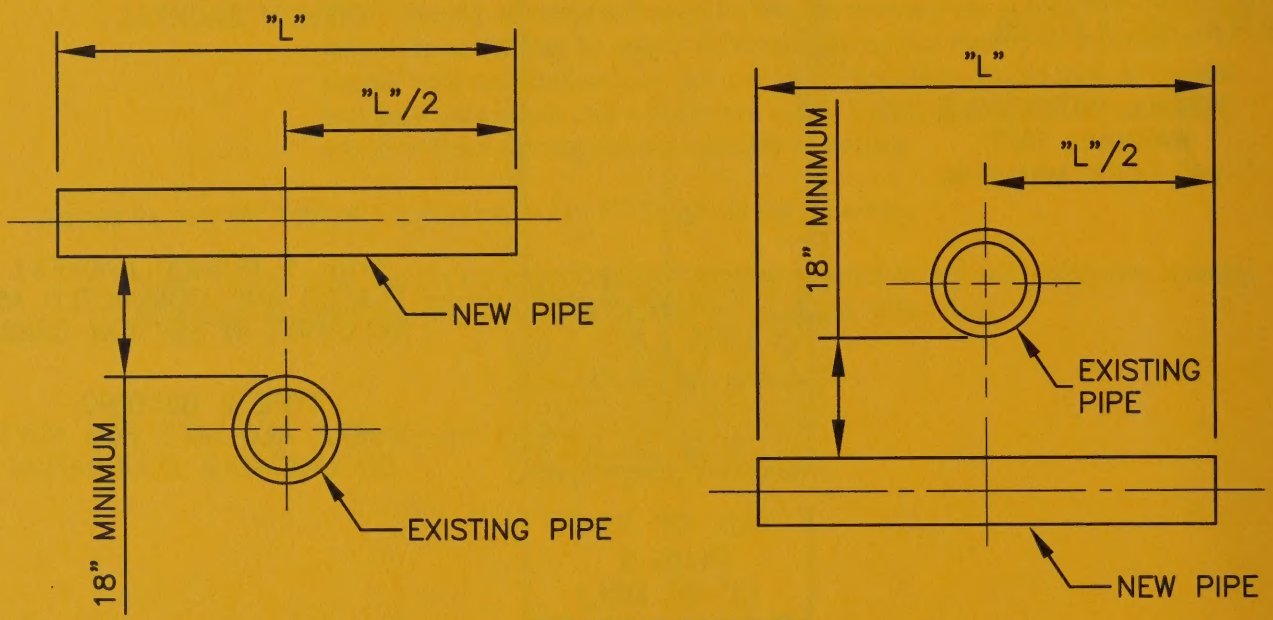
1. WHERE TRENCH PASSES THROUGH EXISTING PAVEMENT, THE PAVEMENT SHALL BE CUT ALONG A NEAT VERTICAL LINE A MINIMUM OF 12" FROM THE EDGE OF THE TRENCH OPENING.
2. WHERE NEAT LINE IS LESS THAN 3' FROM EDGE OF EXISTING PAVEMENT OR CURB AND GUTTER SECTION, REMOVE AND REPLACE ENTIRE PAVEMENT SECTION BETWEEN TRENCH AND EDGE OF PAVEMENT.
3. PROVIDE TEMPORARY CAP OVER THE NON-CONNECTING END OF EACH PIPE PRIOR TO PLACEMENT IN THE TRENCH. REMOVE CAP ONLY WHEN SUBSEQUENT JOINING PIPE IS IN THE TRENCH READY TO BE CONNECTED.

REVISED: 12-3-07

GreatWest engineering	SCALE: NONE	TYPICAL UTILITY TRENCH	MODIFIED STANDARD DRAWING NO. 02221-1



PARALLEL ARRANGEMENT

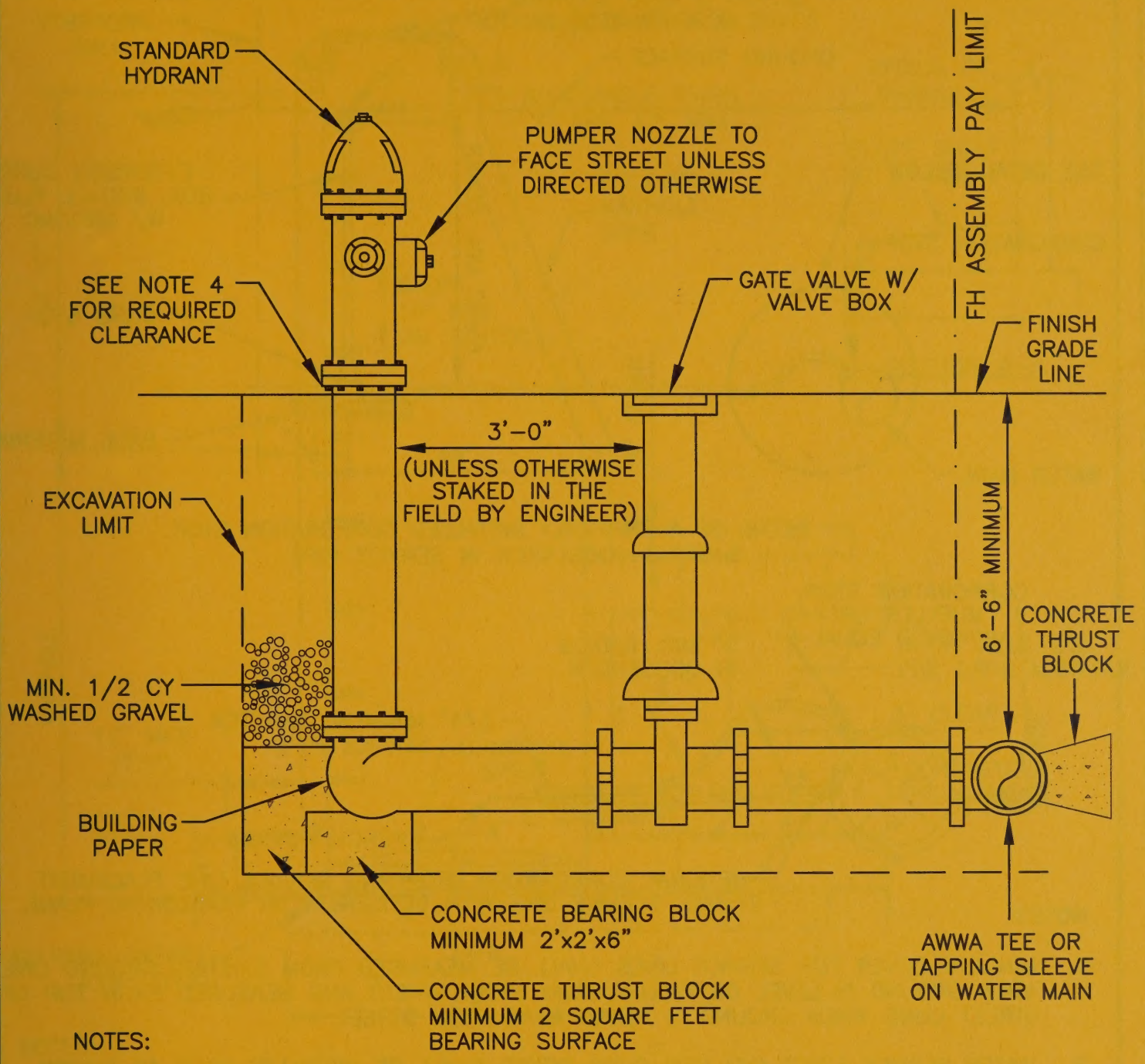


CROSSINGS

NOTES:
1. SPECIFIC MONTANA DEPARTMENT ENVIRONMENTAL QUALITY APPROVAL IS REQUIRED FOR A DISTANCE LESS THAN 10 FEET BETWEEN WATER MAIN AND GRAVITY SEWER.
2. NO EXCEPTION TO THE MINIMUM SEPARATION REQUIREMENT IS PERMITTED WHEN THE SEWAGE CARRYING PIPE IS A FORCE MAIN. AT CROSSINGS, ONE FULL LENGTH OF WATER MAIN PIPE SHALL BE LOCATED SO THAT BOTH JOINTS WILL BE AS FAR FROM THE FORCE MAIN AS POSSIBLE.
3. "L" IS A STANDARD LENGTH OF PIPE AS SUPPLIED BY A PIPE MANUFACTURER.
4. ADEQUATE STRUCTURAL SUPPORT FOR PIPES AT CROSSINGS SHALL BE PROVIDED.

REVISED: 12-3-07

GreatWest engineering	SCALE: NONE	WATER AND SEWER MAIN SEPARATION	MODIFIED STANDARD DRAWING NO. 02660-2

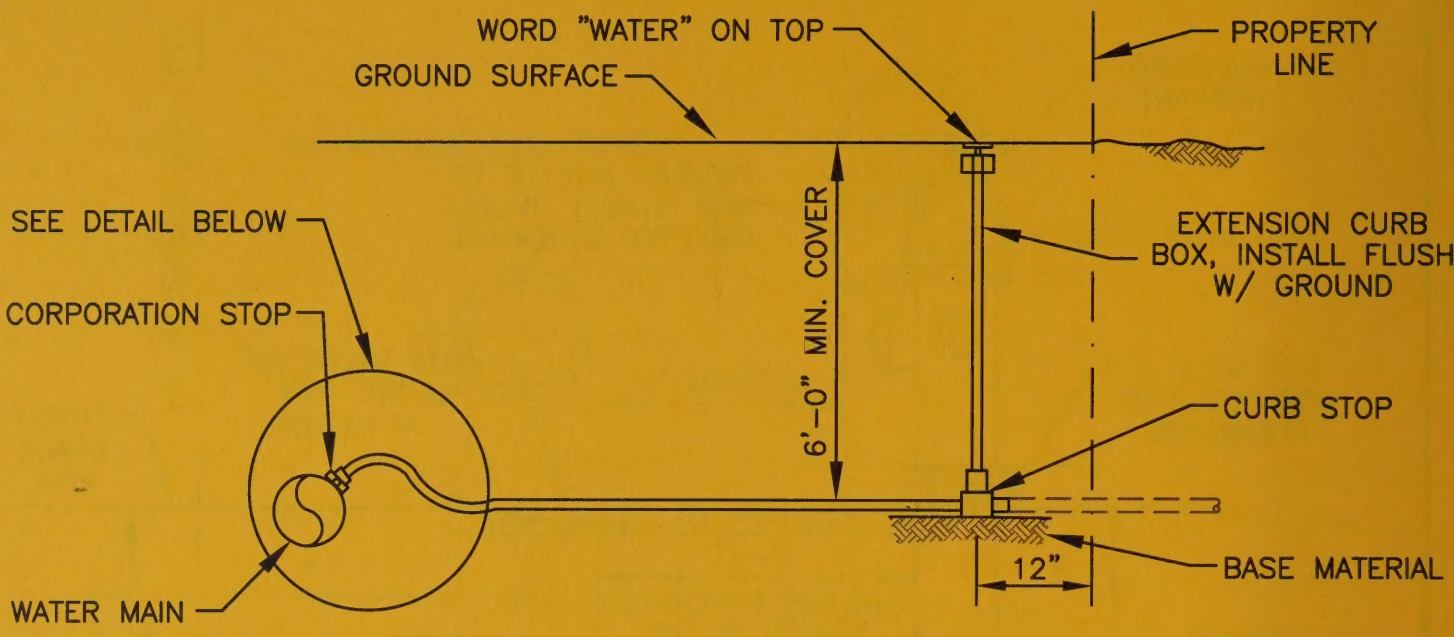


NOTES:

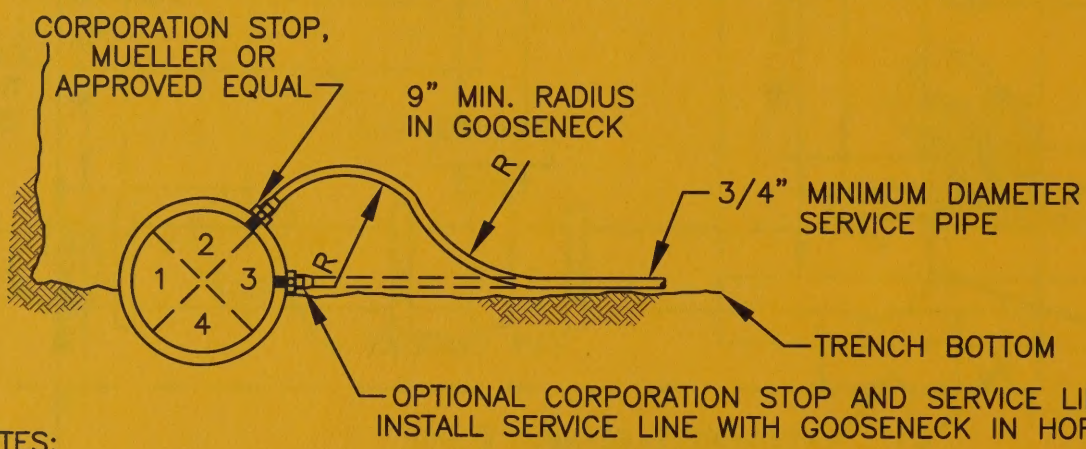
1. THRUST BLOCKING TO BE IN CONFORMANCE WITH DETAIL.
2. FOR BOLTED FITTINGS, BLOCKING SHALL NOT OBSTRUCT BOLTS.
3. HYDRANT WEEP HOLES TO REMAIN UNOBSTRUCTED.
4. HYDRANT BOTTOM FLANGE TO BE 1" TO 2" CLEAR FROM BOLT BOTTOM TO SIDEWALK OR GROUND. CONTRACTOR IS RESPONSIBLE TO VERIFY DEPTH AND RISER LENGTH TO ESTABLISH HYDRANT WITHIN 1" TOLERANCE.

REVISED: 12-3-07

GreatWest engineering	SCALE: NONE	FIRE HYDRANT SETTING	MODIFIED STANDARD DRAWING NO. 02660-4



DETAIL OF A PROPERLY INSTALLED CORPORATION STOP, SHOWING GOOSENECK IN SERVICE PIPE

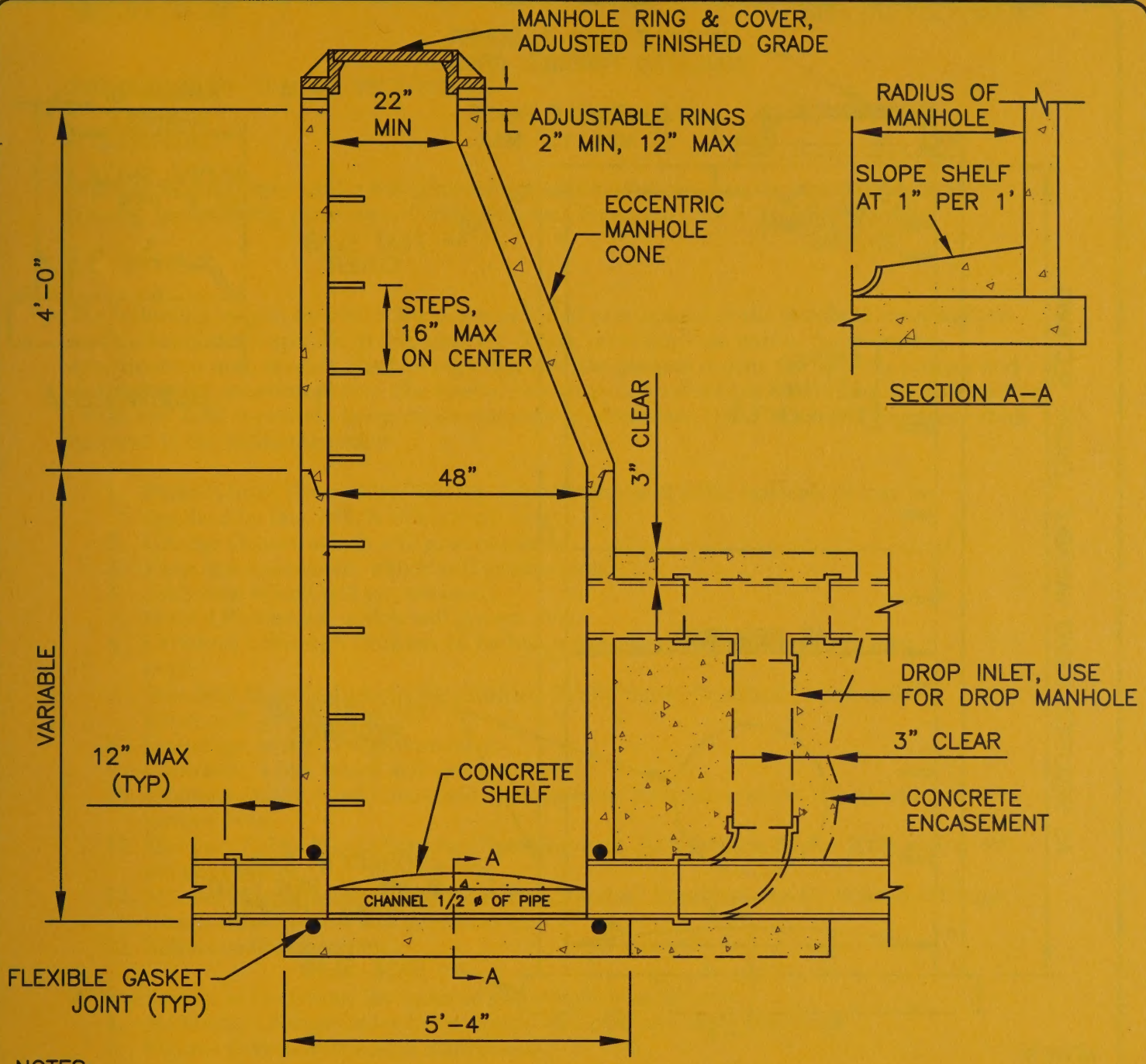


NOTES:

1. MINIMUM COVER FOR SERVICE LINES SHALL BE MEASURED FROM EXISTING GROUND LINE WHEN GROUND IS LEVEL OR FALLING AWAY FROM STREET AND MEASURED FROM TOP OF STREET CURB WHEN GROUND IS RISING AWAY FROM STREET.
2. WATER SERVICE LINES AND NEW CURB BOXES SHALL BE INSTALLED ONLY AS SHOWN ON THE DRAWINGS OR AS SPECIFIED.
3. BEDDING SHALL BE ¾" DIAMETER MAXIMUM WITHIN 6 INCHES OF SERVICE PIPE.
4. PROVIDE 5 POUND MAGNESIUM ANODE WITH EACH COPPER SERVICE LINE.
5. NO FLARED CONNECTIONS WILL BE ALLOWED FOR COPPER SERVICE LINES.
6. PROVIDE NEW SERVICE LINE ENTIRE LENGTH TO CURB STOP.

REVISED: 12-3-07

GreatWest engineering	SCALE: NONE	WATER SERVICE LINE	MODIFIED STANDARD DRAWING NO. 02660-6



NOTES:

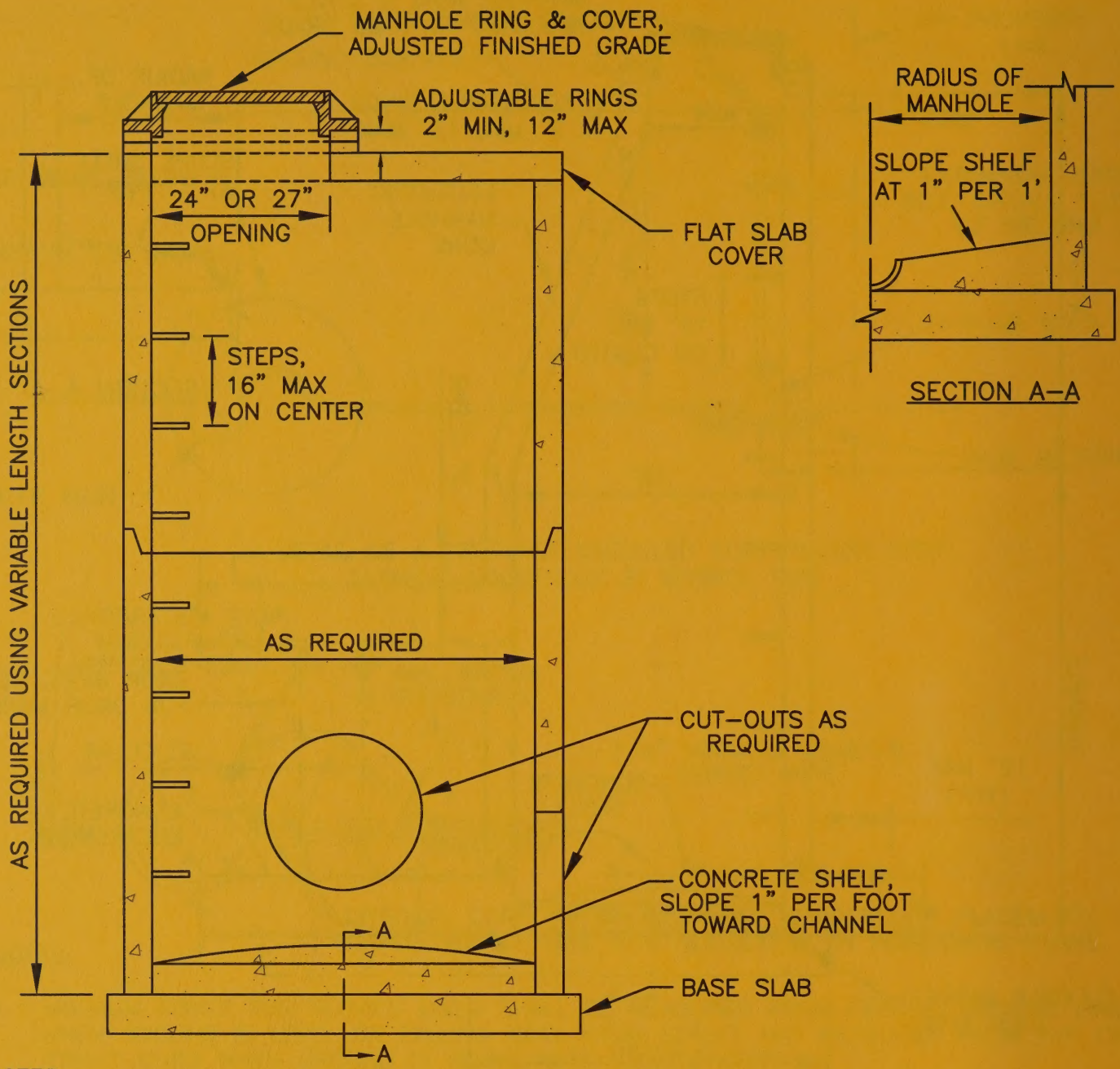
1. ALL JOINTS BETWEEN MANHOLE SECTIONS, ADJUSTING RINGS, MANHOLE RING & TOP SECTION, AND AROUND PIPE INTO MANHOLE SHALL BE WATERTIGHT.

2. JOINTING MATERIAL SHALL BE "RAM-NEK" OR EQUAL FOR ALL JOINTS EXCEPT BETWEEN PIPE AND MANHOLE WALL. FLEXIBLE GASKETED JOINTS SHALL BE USED BETWEEN SEWER PIPE AND MANHOLE WALL.

3. CONCRETE BASE SHALL BE PRECAST OR POURED-IN-PLACE. MINIMUM THICKNESS FOR PRECAST BASE IS 6". MINIMUM THICKNESS FOR POURED-IN-PLACE BASE IS 8".

REVISED: 12-3-07

GreatWest engineering	SCALE: NONE	SANITARY SEWER AND STORM DRAIN MANHOLE	MODIFIED STANDARD DRAWING NO. 02720-3



NOTES:

1. ALL JOINTS BETWEEN MANHOLE SECTIONS, ADJUSTING RINGS, MANHOLE RING & TOP SECTION, AND AROUND PIPE INTO MANHOLE SHALL BE WATERTIGHT.

2. JOINTING MATERIAL SHALL BE "RAM-NEK" OR EQUAL FOR ALL JOINTS EXCEPT BETWEEN PIPE AND MANHOLE WALL. FLEXIBLE GASKETED JOINTS SHALL BE USED BETWEEN SEWER PIPE AND MANHOLE WALL.

3. CONCRETE BASE SHALL BE PRECAST OR POURED-IN-PLACE. MINIMUM THICKNESS FOR PRECAST BASE IS 6". MINIMUM THICKNESS FOR POURED-IN-PLACE BASE IS 8".

REVISED: 7-8-08

GreatWest engineering	SCALE: NONE	STANDARD STRAIGHT MANHOLE	MODIFIED STANDARD DRAWING NO. 02720-4

SECTION 01000 - SPECIAL PROVISIONS

1. GENERAL

Work to be performed under this contract includes earthwork, paving, trail construction, fencing, landscaping, planting and irrigation for Centennial Park in Helena, Montana.

1.1 INTENT

The following special provision items are included to supplement the standard specifications and to clarify items specific to this contract. These provisions are part of the overall specifications and, as such, shall be regarded in a like manner during the bidding process and during the construction phase. The special provision items shall govern during the construction phase and shall supersede items of like nature in the standard specifications. Precedence shall be given in the following order:

1. Permits from Town/City/County Departments and other agencies as may be required by law, which will govern over;
2. Change Orders, which will govern over;
3. Executed Agreement, which will govern over;
4. Addenda, which will govern over;
5. Special Provisions, which will govern over;
6. Divisions 1 through Division 16 Technical Specifications, which will govern over;
7. Standard Modifications to the Montana Public Works Standard Specifications, which will govern over;
8. Drawings, which will govern over;
9. Contractor's Bid, which will govern over;
10. Montana Public Works Standard Specifications 2006 Addendum, which will govern over;
11. Montana Public Works Standard Specifications, Fifth Edition, March 2003, which will govern over;
12. Montana Department of Transportation Standard Specifications for Road and Bridge Construction, which will govern over;
13. Reference Specifications.

With reference to Drawings, the order of precedence is as follows:

1. Addenda/Change Order Drawings govern over any other Drawings.
2. Figures govern over scaled dimensions.
3. Contract Detail Drawings govern over Contract General Drawings.
4. Contract Drawings govern over Standard Drawings.

The project shall be awarded as one general contract. Contractors shall coordinate all construction activities. The intent being to complete the proposed construction in a neat, orderly fashion, in a timely manner, and with a minimum of disturbance to neighbors, and the public.

1.2 INCORPORATION OF THE MPWSS

All provisions of the Montana Public Works Standard Specifications, Fifth Edition, March 2003 and 2006 Addendum, hereafter collectively referred to as the MPWSS, apply to the project, except where portions of the MPWSS are modified or replaced by the Contract Documents. Each Section of the MPWSS that has been modified is listed in the Table of Contents of Section 00950 Standard Modifications to MPWSS. The entire Section from the MPWS has not been

rewritten for these modifications. Instead, modifications are indicted for a specific subsection, paragraph, sentence or drawing.

Where a Standard Modification to MPWSS does not exist for a particular Section of MPWSS it shall be assumed the work is to be completed in accordance with the appropriate MPWSS Section. When a Standard Modification to MPWSS does exist the requirements of that modification supersede the related MPWSS requirement. Where paragraphs are specifically deleted or modified, or new paragraphs added, all other parts of the MPWSS will remain in effect unless otherwise modified by the Project Manual in accordance with the order of governance as specified in "Summary of Work". Forms included in the Project Manual will be used in lieu of similarly titled forms in the MPWSS. Where Technical Specifications follow the Modifications in later Divisions of the Project Manual, those Specifications replace same numbered specifications in the MPWSS.

Delete Part 4: MEASUREMENT AND PAYMENT in all sections of the MPWSS. Payment for an item will only be made if that item is listed as a Bid Item in Section 00300: Bid Form. If an item is listed as a Bid Item, administrative and procedural requirements will be listed in Section 01275: Measurement and Payment. If an item is not listed as a Bid Item, the item is not required or is considered an incidental cost to other Bid Items.

1.3 PREBID EXPLORATION/SITE INFORMATION

There is a high likelihood of encountering contaminated soils and/or waste related to the historic landfill beneath most of the project site. All Bidders are strongly encouraged to visit the site of the work. No pre-bid investigation of subsurface conditions will be permitted due to the possible presence of municipal waste in the subsurface.

1.4 CONTRACTOR USE OF PREMISES

The Contractor shall confine his operations to existing right-of-way and the Owner's property at the site of the proposed work. Materials and equipment may be stored on the project site at the Contractors' Staging Area, or other locations approved in advance by the Owners Representative.

It shall be understood that the responsibility for protection and safekeeping of equipment and materials on or near the site will be entirely that of the Contractor and that no claim shall be made against the Owner by reason of any act of an employee or trespasser.

1.5 PROTECTION OF EXISTING UTILITIES

Existing underground installations such as water mains, gas mains, sewers, telephone lines, power lines, landfill gas extraction system components, monitoring wells, and buried structures in the vicinity of the work to be performed hereunder are indicated on the Drawings only to the extent such information has been made available to or discovered by the Owner in preparing the Drawings. There is no guarantee as to the accuracy or completeness of such information, and all responsibility for the accuracy and completeness thereof is expressly disclaimed.

The Contractor shall be solely responsible for locating all existing underground installations, including service connections, in advance of excavating or trenching. The Contractor shall use his own information and shall not rely solely upon information shown on the Drawings concerning existing underground installations. The Contractor shall repair all damage to existing utilities or property at his own expense. The Contractor shall pay all costs associated

with having utility company representatives on the site for this work and shall include these costs in the price bid for related items of work.

The Contractor is hereby cautioned that all utility services shall be operative and available at all times. The Contractor shall notify water service customers of any water main or water service shutdowns, and shall have all necessary materials, tools, equipment and labor on the site prior to removing the existing lines from service.

In the event underground utilities are damage the Contractor shall notify the Engineer or Architect immediately.

Refer to Part 1.19 of these Special Provisions for additional requirements as it relates to "LANDFILL GAS EXTRACTION SYSTEM/MONITORING WELLS".

1.6 TEMPORARY CONTROLS

A. General

Temporary service shall be provided by the Contractor during any period when utility lines are disturbed unless the Contractor makes other arrangements with the Owners. Service of existing utility lines, if interrupted, shall be restored as quickly as possible.

B. Air and Water Pollution Control

1. Rubbish:

Keep project neat, orderly, and in a safe condition at all times. Provide on-site containers for collection of rubbish and dispose of it at frequent intervals during the progress of work.

2. Dust Control:

Dust control is to be considered an integral part of the Work. Dust Control shall be provided from the start of construction until the Work is complete. Fugitive dust as a result of construction shall be controlled at all times within the subject property. The Contractor shall have a water truck available for dust control prior to beginning any construction tasks. Wetting shall be done a minimum of twice per day in dry conditions or at the direction of the Engineer/Architect or Owner as required until the final construction activities are completed. Contractor shall be prepared to provide dust control until the final surface restoration is completed. All costs incurred to meet dust control requirements are incidental to other items of the contract and no separate payment shall be made.

3. Road and Parking Lot Cleaning:

It shall be the sole responsibility of the contractor to keep all roads and parking lots free from mud, gravel, cobbles or other contaminants generated as a result of construction activities. It shall be the responsibility of the contractor to clean all foreign matter form roads and parking areas in a reasonable amount of time as determined by the Owner & Engineer/Architect. All costs incurred to meet road and parking lot cleaning requirements are incidental to other items of the contract and no separate payment shall be made.

4. Erosion Control Measures:

Temporary erosion and sediment control measures includes the installation and maintenance of temporary structural control measures to reduce or eliminate the erosion of soil and transport of sediment offsite as result of construction activities. This may include, but not be limited to, silt fences, ditch checks, sediment basins, erosion control mats, stabilized construction entrance, temporary diversions, inlet protection, sediment traps, and slope drains. If erosion control measures are required, it shall be the responsibility of the contractor to install and maintain them throughout the construction. All costs incurred to meet erosion control requirements are incidental to other items of the contract and no separate payment shall be made.

5. Noxious Weed Control:

Comply with the County Noxious Weed Management Act, Title 7, Chapter 22, Part 21 and all county and contract noxious weed control requirements. Determine the specific noxious weed control requirements of each county where the project is located before submitting a bid. Equipment and vehicles will be washed prior to entering the project site to remove vegetation to avoid the spread of weeds. All costs incurred to meet noxious weed control requirements are incidental to other items of the contract and no separate payment shall be made.

C. Noise Impact:

To minimize construction noise impacts on the local residents, no mechanized construction activities will be allowed between the hours of 9:00 P.M. and 7:00 A.M. unless explicitly allowed by the Owners Representative in writing.

D. Failure to Provide Service:

If the contractor fails to provide adequate service on the above listed items, the Owner reserves the right to contract these activities to a third party, the cost of which will be deducted from the contract amount at the time of the next pay request.

1.7 PROTECTION OF EXISTING PAVED SURFACES

The Contractor shall protect existing paved surfaces from damage during construction. Keep equipment off paved surfaces. Track equipment shall be provided with suitable pads. *The Contractor shall repair or replace damaged pavement as directed at no cost to the Owner.*

1.8 PRIVATE ACCESS

At all times during construction, afford property owners access to their property to the highest degree possible. Ensure that businesses will have at least one approach open at all times, if possible, and open closed-off approaches as quickly as possible.

1.9 PERMITS

The Contractor shall be responsible for obtaining all permits necessary for the completion of this work. The costs for all permits shall be considered incidental to construction and shall be included in the price bid for related items of work.

This project is subject to Montana Department of Environmental Quality Storm Water General Discharge Permit authorization. The Contractor shall pay the application fee, the first annual fee, and additional annual fees until termination of the permit has been granted by the State. Contractor is responsible for securing and administering the permit, and installation and maintenance of the erosion control structures.

Contractor shall complete and submit a Notice of Intent (NOI) and a Storm Water Pollution Prevention Plan (SWPPP) as required. The NOI shall be completed with the Contractor listed as Operator #1 and the Owner as Operator #2. Operator #1 is responsible for achieving final stabilization and submitting the Notice of Termination (NOT).

Once the NOI and SWPPP have been completed by the Contractor, Contractor shall submit the entire submittal package to the Owner for review and signature. Owner shall respond within five working days following receipt of the submittal.

Contractor shall comply with all requirements and conditions of the General Permit and the SWPPP. Failure to do so will result in issuance of an order to suspend work, in addition to any fines that may be assessed by the State.

All forms may be found on the Internet at the Montana Department of Environmental Quality web site.

1.10 SURVEY MARKERS AND MONUMENTS

The Contractor shall protect and not disturb any survey markers or monuments, such as lot or block corners, property pins, intersection of street monuments, or section corners or section breakdown corners. Any survey marker or monument that is disturbed or destroyed by the Contractor shall be replaced at no cost to the Owner by a licensed land surveyor.

1.11 WORK SCHEDULE

The Contractor shall schedule the work to minimize inconvenience to the Owner, to the general public and to adjacent property Owners, and to minimize interruptions to utility service.

The contract time provided for the construction completion of this project has been figured on the basis of the Contractor working 5 days a week, 8 hours a day, excluding holidays. Should the Contractor decide to work more than the 5 days per week and/or more than 8 hours per day, then approval to do so must be obtained in writing from the Owners Representative so that he may assign the necessary inspection forces.

The Contractor will be allowed only to work during the hours from 7:00 AM to 6:00 PM. Should the Contractor decide to work beyond the hours indicated, then approval to do so must be obtained in writing from the Owners Representative so that he may assign the necessary inspection forces. Please note any inspection forces required beyond 8 hours per day will be subject to the terms of "Unscheduled Employment of the Engineer or Architect" contained within these Special Provisions.

1.12 LITIGATION LOCATION

In the event litigation is pursued under this contract, it will be in the District Court of Lewis and Clark County.

1.13 USE OF WATER

Should the Contractor desire or elect to use water for compaction or other purposes, he shall make proper arrangements with and pay necessary fees to the City of Helena.

1.14 SURETY BONDS

The surety bonds shall be in a form acceptable to the City of Helena and shall be executed by a Surety Company authorized by law to transact such business in the State of Montana.

1.15 PUBLIC CONTRACTOR'S LICENSE

The bidder must be licensed as a Public Contractor prior to submitting a bid. All bids and proposals shall contain a statement showing bidder is duly and regularly licensed, and must show number and class of license held by bidder. No subcontracted work, the contract price of which exceeds the sum of One Thousand Dollars ($1,000.00), shall be commenced by a Subcontractor before the Subcontractor obtains a license as a Public Contractor. Refer to Title 15, Chapter 50, Montana Code Annotated. All of the provisions, requirements and stipulations of said Sections and subsequent amendments being made a part hereof.

1.16 TESTING

Complete testing of all components of the project will be required to the satisfaction of the Owner and the Engineer/Architect. Remedy all defects and performance problems revealed by the testing to the satisfaction of the Engineer/Architect by the Contractor at no additional expense to the Owner.

The Engineer will conduct the following tests at no cost to the Contractor:

1. On-site moisture and density testing of trench backfill, embankments, engineered fill placement, crushed base course, and asphalt pavement.

2. On-site moisture and density testing of softball infield and warning track subgrade, infield base, infield and warning track surfacing.

Should the materials fail to meet the test specified, the Contractor will pay the costs of all retests conducted by the Engineer, or the Contractor may elect to have an approved testing laboratory conduct retests at the Contractor's expense.

The Contractor will be responsible for conducting and paying for the following tests:

1. Laboratory analysis of concrete aggregate.

2. Slump and Air Entrainment tests for concrete.

3. Taking and breaking of concrete test cylinders.

4. Gradations for gravels, bedding, and base materials as specified.

5. Gradations for seal coat aggregate as specified.

6. Gradations for riprap, liner protective cover, liner subgrade materials.

7. Gradations for softball infield and warning track surfacing.

8. Conformance testing of PVC liner.

9. Proctors for different materials and gravels used for backfill.

10. Pressure testing of services (water, sewer & irrigation).

11. Marshall and core testing for bituminous asphalt concrete.

12. Re-testing of failed tests that were conducted by the Engineer.

13. Other tests as outlined in the Technical Specifications.

All tests which are the responsibility of the Contractor must be conducted by an approved, certified testing laboratory or individual. Acceptance or rejection of materials will generally be determined from tests made in-place in the field.

The following is a frequency testing table for soils and concrete:

Quality Control Frequency Table

SECTION	ITEM DESCRIPTION	TEST OR SUBMITTAL	FREQUENCY
GENERAL			
Varies	All Materials	Sieve Analysis	Every New Material
Varies	All Materials	Atterberg Limits	Every New Material
Varies	All Materials	Lab. Max Density	Every New Material
02221	Type 1Pipe Bedding	Field Density/Moisture Content	1 test / 200 LF
02221	Pipe Bedding Alternate	Field Density/Moisture Content	1 test / 200 LF
02221	Type 2 Pipe Bedding	Field Density/Moisture Content	1 test / 200 LF
02221	Type 'A' Trench Backfill	Field Density/Moisture Content	1 test / 200 LF / lift
02221	Type 'B' Trench Backfill	Field Density/Moisture Content	1 test / 300 LF / lift
02221	Type 'C' Trench Backfill	Field Density/Moisture Content	1 test / 400 LF / lift
02300	Select Fill/Structural Fill	Field Density/Moisture Content	1 test / 1,000 SF / lift
02300	Drainage Course	Field Density/Moisture Content	1 test / 1,000 SF / lift
02300	Filter Material	Field Density/Moisture Content	1 test / 200 LF / lift
02320	Pond Embankment	Field Density/Moisture Content	1 test / 5,000 SF / lift
02320	Pond Liner Subgrade (Includes native material, processed material, and all base courses below the liner.)	Field Density/Moisture Content	5 tests / acre / lift
GENERAL – ROADWAY			
Varies	All Materials	Sieve Analysis	Every New Material
Varies	All Materials	Atterberg Limits	Every New Material
Varies	All Materials	Lab. Max Density	Every New Material

02230	Borrow / Embankment Fill	Field Density/Moisture Content	1 test / 5,000 SF / lift
02230	Original Ground / Native Subgrade	Field Density/Moisture Content	1 test / 5,000 SF / lift
02234	Sub-Base Course(s)	Field Density/Moisture Content	1 test / 2,500 SF / lift
02234	Sub-Base Course(s)	R-Value	Every New Material
02234	Sub-Base Course(s)	Fractured Face	Every New Material
02234	Sub-Base Course(s)	Sand Equivalent	Every New Material
02234	Sub-Base Course(s)	% of Wear (500 rev.)	Every New Material
02235	Base Course(s)	Field Density	1 test / 2,000 SF / lift
02235	Base Course(s)	R-Value	Every New Material
02235	Base Course(s)	Fractured Face	Every New Material
02235	Base Course(s)	Sand Equivalent	Every New Material
02235	Base Course(s)	% of Wear (500 rev.)	Every New Material
STRUCTURES			
Varies	All Materials	Sieve Analysis	Every New Material
Varies	All Materials	Atterberg Limits	Every New Material
Varies	All Materials	Lab. Max Density	Every New Material
03310	Structural Concrete	Mill Certificates	With Every Mix Design
		Mix Design	Every Concrete Class
		Air Content	1 test / 75CY / Day
		Slump	1 test / 75CY / Day
		Compressive Strength	1 test / 75CY / Day
		Temperature	1 test / 75CY / Day
	Original Ground and Base of Cuts (Native Subgrade)	Field Density/Moisture Content	1 test / 1,500 SF
ASPHALT (PLANT MIX BITUMINOUS SURFACE)			
02510	Plant mix	Mix Design	
		Plant Inspection	As Required by Engineer.
		Asphalt Content	With Every Mix Design
		Sieve Analysis	With Every Mix Design
		Marshall Stab. & Flow	With Every Mix Design
		Field Density	1 test / pass with roller
		Temperature	Each Truck

1.17 CONSTRUCTION STAKING

The Engineer will provide horizontal control for the project consisting of stakes along the project baseline. Vertical control will be provided by benchmarks throughout the project site. All offset staking is the Contractors responsibility. The Contractor shall protect all control points during the course of their work and replace any points damaged or removed by their activities. All survey monuments and stakes provided by the Contractor shall be subject to inspection and verification by the Engineer. The Contractor shall provide all additional staking necessary for vertical and horizontal control such that the project may be completed in accordance with the plans and specifications.

The Engineer shall provide the following staking consisting of stakes or hubs.

- Vertical Control – Vertical control will be provided by benchmarks throughout the project site.
- Piping – Horizontal control will be given at each change in horizontal alignment, pipe termination, structure, valve and each fitting. Intermediate staking will be placed on centerline a minimum of every 200 feet. Irrigation system piping is not included.
- Structures and Manholes – Horizontal control will be given at the centerline of each new structure and manhole.
- Tree planting and berm construction – Horizontal control will be given by a stake at the center location of the tree.
- Fence Corners and Gates.
- Roadway – Horizontal control will consist of a minimum of each PC and PT along the centerline of the new road. Intermediate staking on centerline will be placed a minimum of every 50 feet.
- Softball Fields – Staking of future fence and backstop locations, and perimeter of warning track and infield will be provided.
- Property Lines – Property line staking on the west side of the project between City owned property and Carroll College will be provided.

The Contractor will be required to bluetop the road surface at 50-foot minimum intervals (centerline and edge of road) at the following times;

- Prior to final grading of subgrade.
- Prior to final grading of crushed top course.

The tolerances for road subgrade shall meet the requirements of the Montanan Department of Transportation Standard Specifications. The finished elevations shall not deviate from the plan elevation more than 0.05 feet at any given point. Finished centerline horizontal alignment shall not deviate from plan location more than 0.2 feet.

1.18 UNSCHEDULED EMPLOYMENT OF THE ARCHITECT/ENGINEER

Damages for the unscheduled employment of the Architect/Engineer and/or Inspector will be assessed against the Contractor necessitated by: (1) the Contractor working beyond the specified contract time; (2) the Contractor working more than 8 hours per day, (or 40 hours per

week if four ten hour shifts are run) or on Saturdays, Sundays, and Federal Holidays; (3) the Contractor utilizing material, supplies, or equipment that requires the redesign of the project; (4) the Contractor destroying or disturbing baselines benchmarks or reference stakes; (5) the failure of the Contractor to maintain acceptable as-built records, and (6) review of submittals that were returned to the Contractor requiring revision or resubmittal.

Damages for the unscheduled employment of the Architect/Engineer and/or Inspector will be determined based on the following hourly rates:

Straight Time	
Landscape Architect (Principal)	$88.00/Hour
Landscape Architect I	$69.00/Hour
Landscape Architect II	$45.00/Hour
Draftsman	$52.00/Hour
Principle Engineer	$130.00/Hour
Project Manager Engineer	$115.00/Hour
Project Engineer	$93.00/Hour
Resident Project Representative (RPR)	$88.00/Hour
RPR Overtime Rate	$132.00/Hour
Clerical	$47.00/Hour
Mileage	$ 0.65/Mile
Survey Crew	$160.00/Hour
GPS Rental	$400.00/Day
Nuclear Densometer	$75.00/Day

The rates listed herein are subject to changes on January 1st of each year.

Out of pocket expenses for materials, equipment, supplies, transportation, and subsistence will be billed at cost plus ten percent. Damages for unscheduled employment of the Architect/Engineer and/or Inspector will be deducted from monthly progress payments and the final payment as the damages are incurred. Damages for unscheduled employment of the Architect/Engineer are independent from liquidated damages for delay as described in the agreement.

1.19 LANDFILL GAS EXTRATION SYSTEM/MONITORING WELLS

The majority of the project will be constructed on a closed landfill. Within the YMCA parking lot and along the west property line is a landfill gas extraction system. The Contractor is to verify the location of all landfill gas extraction system components and protect all components from damage due to construction activities. In addition, there are several monitoring wells located at the site. The Contractor is to verify the locations of these wells and protection them from damage. The Contractor is responsible for the costs of repairs of any landfill gas extraction system or monitoring wells.

The Contractor and its employees should be aware that the landfill gas extraction system, if damaged, may contain and leak explosive levels of methane. If any part of the landfill gas extraction system is damaged, the Contractor shall immediately stop work and evacuate the area in the vicinity around the gas extraction system. All damage if cause shall be reported immediately to the Engineer.

1.20 DISPOSAL OF ENCOUNTERED LANDFILL WASTE

If waste is encountered in excavation areas or utility trenches the Contractor shall notify the Engineer/Architect. All waste shall be disposed of at the City Transfer station. The Contractor shall keep a record of all weights shipped to the transfer station and document all locations in which waste is encountered. The Owner will have a special account established for the project. The tipping fee at the City/County Transfer station will be paid directly by the Owner. If waste is encountered that is not able to be disposed of at the Transfer Station, the Contractor shall notify the Engineer/Architect.

1.21 DOCUMENTATION OF ENCOUNTERED WASTE

The Contractor must take the following measures in order to receive payment for this Bid Item. When landfill waste is encountered during the project, the Contactor shall immediately notify the Engineer/Architect, provide photos of the waste, and record location, extent of waste encountered and restored on a record drawing.

1.22 CONTRACTOR HEALTH AND SAFETY PLAN

In addition to those health and safety hazards associated with heavy construction work, this project requires municipal waste to be excavated, hauled and disposed of at the City/County Transfer Station. These materials may contain harmful metals or chemicals. The Contractor shall prepare and submit to the Engineer/Architect a Health and Safety plan in accordance with all OSHA regulations including standards for General Industry, Hazardous Waste, and Construction.

1.23 OWNER PROVIDED MATERIALS COORDINATION

The Owner will be providing 3,500 cubic yards of general site fill. This site fill will be hauled and dumped by a third party contractor in areas requiring fill as determined by the Engineer. The Contractor shall coordinate with the third party contractor to facilitate the dumping locations of this Owner provided material. The Contractor will be required to place, grade and compact this material. No separate payment will be made for any coordination required.

1.24 YMCA AND STATE OF MONTANA BUILDING PARKING/ACCESS PLAN

The Contractor shall provide temporary access and parking for both the YMCA and State of Montana building at all times during construction. The Contractor shall prepare a temporary access and parking plan and submit this plan to the Architect for approval. The plan should provide provisions for providing a minimum of 50 stalls for the YMCA and a minimum of 75 stalls for the State of Montana building at all times. The plan should also include the proposed access routes for all phases of construction. The plan shall take into account inclimate weather as well. The Contractor shall be responsible for facilitating ADA access as needed. In addition, the plan shall include proposed haul and access routes for materials to be delivered to the site.

1.25 IN-STATE CONTRACTOR PREFERENCE

Contractor preference award as applicable to this project is covered by Section 18-1-102 MCA, which is included herein for convenience of bidders. Contractor is responsible for ensuring that all State and Federal Requirements are satisfied, as applicable to this project.

18-1-102. State contracts to lowest bidder -- reciprocity.

(1) In order to provide for an orderly administration of the business of the state of Montana in awarding public contracts for the purchase of goods and for construction, repair, and public works of all kinds, a public agency shall award:

(a) A public contract for construction, repair, or public works to the lowest responsible bidder without regard to residency. However, a resident bidder must be allowed a preference on a contract against the bid of a nonresident bidder from any state or country that enforces a preference for resident bidders. The preference given to resident bidders of this state must be equal to the preference given in the other state or country.

(b) a public contract for the purchase of goods to the lowest responsible bidder without regard to residency. However, a resident must be allowed a preference on a contract against the bid of a nonresident if the state or country of the nonresident enforces a preference for residents. The preference must be equal to the preference given in the other state or country.

(2) The preferences in this section apply:

(a) whether the law requires advertisement for bids or does not require advertisement for bids; and

(b) to contracts involving funds obtained from the federal government unless expressly prohibited by the laws of the United States or regulations adopted pursuant to federal laws.

1.26 USE OF MONTANA WORKERS ON PUBLIC CONTRACTS

Use of Montana resident workers as applicable to this project is covered by Section 18-2-403 MCA and 18-2-409, which is included herein for convenience of bidders. Contractor is responsible for ensuring that all State and Federal Requirements are satisfied, as applicable to this project.

The term "public works contract" as used in the statute is defined in Section 18-2-401(11)(a), MCA, as including a contract for construction services let by the state, county, municipality, school district, or political subdivision or for nonconstruction services let by the state, county, municipality, or political subdivision in which the total cost of the contract is in excess of $25,000.

18-2-403. Preference of Montana labor in public works -- wages -- tax-exempt project -- federal exception.

(1) In every public works contract, there must be inserted in the bid specification and the public works contract a provision requiring the contractor to give preference to the employment of bona fide residents of Montana in the performance of the work.

(2) All public works contracts for construction services under subsection (1), except those for heavy and highway construction, that are conducted at the project location or under special circumstances must contain a provision requiring the contractor to pay:

(a) the travel allowance that is in effect and applicable to the district in which the work is being performed; and

(b) the standard prevailing rate of wages, including fringe benefits for health and welfare and pension contributions, that:

(i) meets the requirements of the Employee Retirement Income Security Act of 1974 and other bona fide programs approved by the United States department of labor; and

(ii) is in effect and applicable to the district in which the work is being performed.

(3) In every public works contract for heavy and highway construction, there must be inserted a provision to require the contractor to pay the heavy and highway construction wage rates established statewide for heavy and highway construction services conducted at the project location or under special circumstances.

(4) Except as provided in subsection (5), all public works contracts for nonconstruction services under subsection (1) must contain a provision requiring the contractor to pay:

(a) the travel allowance that is in effect and applicable to the district in which the work is being performed; and

(b) the standard prevailing rate of wages, including fringe benefits for health and welfare and pension contributions, that:

(i) meets the requirements of the Employee Retirement Income Security Act of 1974 and other bona fide programs approved by the United States department of labor; and

(ii) is in effect and applicable to the district in which the work is being performed.

(5) An employer who, as a nonprofit organization providing individuals with vocational rehabilitation, performs a public works contract for nonconstruction services and who employs an individual whose earning capacity is impaired by a mental, emotional, or physical disability may pay the individual wages that are less than the standard prevailing wage if the employer complies with the provisions of section 214(c) of the Fair Labor Standards Act of 1938, 29 U.S.C. 214 and 29 CFR, part 525, and the wages paid are equal to or above the minimum wage required in 39-3-404.

(6) Transportation of goods, supplies, materials, and manufactured or fabricated items to or from the project location is not subject to payment of the standard prevailing rate of wages.

(7) A contract, other than a public works contract, let for a project costing more than $25,000 and financed from the proceeds of bonds issued under Title 17, chapter 5, part 15, or Title 90, chapter 5 or 7, must contain a provision requiring the contractor to pay the standard prevailing wage rate in effect and applicable to the district in which the work is being performed unless the contractor performing the work has entered into a collective bargaining agreement covering the work to be performed.

(8) A public works contract may not be let to any person, firm, association, or corporation refusing to execute an agreement with the provisions described in subsections (1) through (7) in it, provided that in public works contracts involving the expenditure of federal-aid funds, this part may not be enforced in a manner as to conflict with or be contrary to the federal statutes prescribing a labor preference to honorably discharged veterans of the armed forces and prohibiting as unlawful any other preference or discrimination among citizens of the United States.

(9) Failure to include the provisions required by 18-2-422 in a public works contract relieves the contractor from the contractor's obligation to pay the standard prevailing wage rate and places the obligation on the public contracting agency.

18-2-409. Montana residents to be employed on state construction contracts.

(1) On any state construction project funded by state or federal funds, except a project partially funded with federal aid money from the United States department of transportation or when residency preference laws are specifically prohibited by federal law and to which the state is a signatory to the construction contract, each contractor shall ensure that at least 50% of the contractor's workers performing labor on the project are bona fide Montana residents, as defined in 18-2-401.

(2) For any contract awarded for a state construction project, except a project partially funded with federal aid money from the United States department of transportation or when residency preference laws are specifically prohibited by federal law, there must be inserted in the bid

specification and the contract a provision, in language approved by the commissioner of labor and industry, implementing the requirements of subsection (1). The bid specification and the contract must provide that at least 50% of the workers on the project will be bona fide Montana residents. If due to a lack of qualified personnel each contractor cannot guarantee that at least 50% of the contractor's workers on the project will be Montana residents, the contract must provide that the percentage that the commissioner of labor and industry believes possible will be Montana residents.

(3) The commissioner of labor and industry shall enforce this section and investigate complaints of its violation and may adopt rules to implement this section.

2. SPECIAL CONDITIONS

2.1 CONSTRUCTION TRAFFIC CONTROL.

Notices and procedures shall be accomplished as per MPWSS Section 01570.

The MPWSS Section 01570 impacted parties (for notice purposes) shall include:

1. All City Ambulance Operators.
2. The City of Helena Fire and Police Departments.

2.2 MATERIALS SOURCES AND DELIVERY.

It shall be the responsibility of the Contractor to fully investigate and satisfy himself as to the availability of all materials required under this Contract.

2.3 MATERIALS

All materials provided by the Contractor for this project shall be new material. Materials required for a complete installation but not specifically described in the specifications or on the plans shall be as selected by the Contractor subject to approval by the Owners Representative.

2.4 DISPOSAL AREAS

All waste materials of this contract shall be disposed of in a legal manner in a location off site as selected by the Contractor.

2.5 USE OF RIGHT-OF-WAY AND ADJOINING PROPERTY.

The Contractor shall contain all of his construction operations within the right-of-way unless written approval is secured from the Owner of the adjoining property.

2.6 SANITARY FACILITIES.

The Contractor shall provide sanitary facilities for use by the construction personnel.

2.7 PROTECTION OF TREES.

The Contractor working on public rights-of-way or properties shall be responsible for the prevention of damage to trees located within or infringing on the public rights-of-way and properties. The Contractor shall exercise care in driving or working on the root zone area of trees to prevent excessive compaction of the soil. Nails, bolts, or other fastening materials shall not be imbedded into the trunk or limbs of a tree. Ropes, wires, or other hanging materials shall

not be attached to a tree in such a manner that the bark may be damaged or cause undue stress to the plant structure.

Any overhanging branches or underlying roots which may be crushed, scarred, broken, or damaged in any way due to unavoidable construction activity shall be reported to the City Forester so that preventive action may be taken to minimize tree damage. Any trees damaged shall be the responsibility of the Contractor to repair or replace as determined by the City Forester and the valuation shall be determined by "Landscape Trees, Shrubs and Other Plants," published by International Society of Arboriculture.

Prior to backfilling any trench or ditch the City Forester shall be notified to inspect any repairs made to damaged roots. All exposed roots shall be pruned, or trimmed using a hand pruner or hand saw. Axe cuts will not be allowed.

Upon completion of construction, the Contractor shall notify the City Forester for a final inspection of the trees whether or not any damage occurred. Any damage found to have been caused by the construction activity of the Contractor shall be the remedial responsibility of the Contractor.

2.8 ALTERNATIVES

Where applicable, requirements of Contract Documents apply for alteration work in same manner as for new work. Refer to drawings for specific requirements of alteration work.

Alternates are defined as alternate products, materials, equipment, installations or systems for the work which may be selected to either supplement or displace corresponding basic requirements of Contract Documents. Alternates must equal or exceed the performance, operation, and specification limitations if a particular brand name is listed as an example for minimum requirements.

A schedule of Alternates is included on the bid form. Each alternate is defined by abbreviated language, recognizing that drawings and specification sections document the requirements. Coordination of related work as required to ensure that work affected by each selected alternate is complete and properly interfaced with work of alternates shall be the Contractors' responsibility. Immediately following award of Contract prepare and distribute to each entity to be involved in performance of the work, a notification of status of each alternate.

2.9 PROJECT SUPERINTENDENT

The Contractor shall designate a project superintendent, approved in advance by the Owner's Representative, who shall be present on the job at all times work is in progress. The superintendent shall direct and be responsible for all work performed under the contract and shall be the day-to-day contact within the Contractor's organization regarding the contract.

The project superintendent may only be changed by the Contractor with advance written permission of the Owner's Representative. Any replacement superintendent shall be equally qualified and must be acceptable to the Owner's Representative.

The project superintendent must continue to perform in a manner satisfactory and acceptable to the Owner's Representative. If the project superintendent fails to perform satisfactorily the Owner's Representative may request removal of the superintendent and immediate replacement with another qualified supervisor who must be acceptable to the Owner's

Representative. The Contractor agrees to comply with this condition which shall be solely determined by the Owner's Representative.

2.10 CONTRACTOR'S COMMUNICATION SERVICES

The Contractor shall maintain a local telephone number where the project superintendent or a qualified assistant may normally be reached during business hours. The Contractor shall also maintain a 24-hour telephone number where he may be reached during an emergency. Failure to answer these telephones, failure to respond to calls, or negligence in carrying out the provisions of this contract may result in cancellation of the contract or forfeiture of remaining contract payments by the Owner.

2.11 CONTRACTOR'S RESPONSIBILITY

The Contractor agrees and recognizes that he is responsible to and shall comply with the reasonable requests and directions of the Owner's Representative throughout the term of the contract.

2.12 HERBICIDE APPLICATION AND DISKING

All existing turf areas and the slope adjacent to Lyndale Avenue shall be sprayed with an herbicide to kill the existing turf material. Following the period specified by the manufacturer, disk the treated area to break up the surface sod. Disk a minimum of 2" deep without coming in contact with landfill waste.

2.13 SCREENING OF DECOMPOSED GRANITE

Decomposed granite used for softball infield surfacing and warning track surfacing shall be screened and mixed as specified.

Screening of decomposed granite is not required for use in surfacing of trails and fire access roads. Any material larger that 1-1/2" that does not consolidate during compaction shall be removed by the Contractor.

2.14 DEMOLITION OF EXISTING IRRIGATION EQUIPMENT

Contractor shall provide miscellaneous demolition of existing irrigation equipment as part of the site demolition. Perform all demolition in a workmanlike manner so that existing facilities designated to remain are not damaged.

Existing equipment to be removed includes the following:

- Valves boxes and associated gate valves, control valves, and quick coupling valves (Approximately 40). Boxes will be located by Owner. Low spots created by removal of box to be backfilled at time of removal.

All other equipment to be abandoned in place. Any irrigation equipment or piping that is brought to the surface during construction shall be removed from the site.

Owner may elect to salvage irrigation heads, valves, etc. Contractor shall provide the Owner with the ample time to remove any equipment to be salvaged.

2.15 EARTHWORK QUANTITIES

All earthwork quantities on the Bid Form including but not limited to imported fill, gravel, topsoil, etc. are in place and compacted.

2.16 IRRIGATION SYSTEM TRENCHING & PULLING

The Contractor shall bear all responsibility for the safety of trenches at all times. Erect temporary fencing and signing as deemed necessary to prevent injury to all persons using the property during construction. Close all trenches as soon as practical following completion of work.

All mainlines shall be installed by open trenching. All laterals shall be installed either by open trenching or pulling.

If the laterals are pulled, the Contractor must demonstrate that his equipment and installation methods shall result in installation of lateral piping and equipment as specified to the complete satisfaction of the Owner's Representative. The Owner's Representative shall issue written acceptance of pulling for lateral installation before any pulling shall commence.

2.17 IRRIGATION SYSTEM TRENCH/PULL LINE RESTORATION

A. Trenching:

All trenches shall be backfilled as specified in this project manual. Trenches shall be closed and surfaces restored as each section of the project is completed, prior to installation of laterals.

The top 4" minimum of trench backfill shall be made with imported topsoil. If topsoil is placed prior to installation of the irrigation system, topsoil from the trench excavations shall be acceptable provided that it is segregated during trenching. All backfill shall be settled/compacted to preclude trench settlement.

B. Pulling:

All pull lines shall be rolled with a self propelled vibratory roller as necessary immediately following completion of pipe installation. Finished pull lines shall be at the same grade as adjacent undisturbed areas. Pull restoration shall satisfy the Owner's Representative at all times. Where unsatisfactory pull restoration is identified by the Owner's Representative, Contractor shall make all additional restorative efforts, as directed, until satisfactory restoration conditions are achieved.

2.18 SOD INSTALLATION AT DRAIN DITCHES

Drain ditches constructed in irrigated turf areas shall be planted with sod. Sod shall extend 5' from centerline on both side of the ditch.

2.19 TRAFFIC CONTROL AT SIDEWALKS

Pedestrian traffic control measures shall be put in place at sidewalks that run adjacent to the project as required by the American with Disabilities Act and according to all local, state, and federal requirements. Contractor shall be responsible for the installation and maintenance of any installed measures through the duration of the project.

2.20 IMPORTED TOPSOIL

Imported topsoil shall be loose, friable, loamy soil free of excess acid and alkali. Topsoil shall not contain objectionable amount of sod, hard lumps, gravel, sub-soil, sticks, roots, trash, or other undesirable material. Topsoil shall be free of stones 1 inch or larger. Imported topsoil must be tested and approved prior to importing. Submit certification that topsoil has supported growth of healthy crops, turf, etc. prior to importing.

Topsoil shall be tested in place and approved in writing prior to beginning importing operations. Provide additional test results for every 4,000 cubic yards of imported topsoil. Topsoil shall comply with ASTM D 5268. Provide topsoil analysis by a qualified soil-testing laboratory stating the material meets the following requirements:

1. pH:	5.5 - 8.0
2. Organic matter (%):	1 – 5
3. Olsen Phosphorus (mg/kg):	1 – 150
4. Potassium (mg/kg):	100 – 1500
5. Sodium (meq/100g):	<2.0
6. Calcium (meq/100g):	0.2 – 5.0
7. Sulfate (mg/kg):	1 – 1,500
8. Conductivity (mmhos/cm):	<3.0
9. Sodium Absorption Ratio (SAR):	<6.0
10. Lime (qualitative):	< Moderate
11. Sand (%):	15 – 60
12. Silt (%):	10 – 60
13. Clay (%):	5 – 30

Contractor shall pay for all costs associated with testing.

2.21 CONTRACTOR'S LIABILITY INSURANCE

Listing of the Architect and the Architect's Consultants as additional insureds shall conform to the Insurance Services Office (ISO) endorsement CG 2032 "Additional Insured – Engineers, Architects or Surveyors Not Engaged by the Named Insured". Copies of the additional insured endorsement shall be provided to the Architect for approval prior to execution of the contract.

2.22 SUBSTITUTION REQUESTS

All requests for substitution of materials for incorporation in the work of this contract shall be made and approved or rejected prior to bid date. All requests for substitution shall be made as required by Division 1 of this specification. Incomplete or non-conforming requests shall be rejected.

All requests for substitution shall be delivered to the Architect ten days prior to the Bid Date. Proposal requests arriving after said date and time will not be considered. The Architect shall review all requests received and issue written notice of approval or rejection to the submitting entity. Opinion of the Architect shall be final.

Written notice of approved substitutions shall be issued to all planholders by addendum.

2.23 IMPORTED SOIL CHEMICAL ANALYSIS

All imported soil used at the project shall be free of petroleum hydrocarbon contamination and elevated metals. Prior to importing soil to the project site, the Contractor shall have all imported soil sources analyzed for arsenic, barium, cadmium, chromium, lead, selenium, silver, and mercury (RCRA metals) and compared to the Residential Soil Screen Levels for the respective constituents. It is the Contractor's responsibility to verify that all imported soil sources are free of petroleum contamination and elevated metals prior to bidding. Each source shall have a minimum of one 5-point composite sample for every 10,000 cubic yards of imported material with a minimum of one composite sample per source. The samples shall be collected from the source(s) at various depths. The results of that analysis shall be submitted to the Architect/Engineer for approval prior to importing soil. No source shall be approved if any of the applicable screening levels are exceeded. During placement of fill materials, the owner or their representatives has the option to select up to five (5) additional 5-point composite samples at the points of placement. The Contractor shall collect, deliver the laboratory, pay for, and provide laboratory reports for all required sampling. Sampling and analysis costs will not be paid separately. The cost of all required sampling and analysis should be included into each respective bid item.

Should imported soil originate from an MDEQ-licensed gravel source, samples collected by the owner as part of the permitting or gravel source characterization may be used to demonstrate that the source does not contain RCRA metals above the site-specific cleanup standards.

3. MEASUREMENTS AND PAYMENTS

3.1 SCOPE

The intent of the plans and specifications is to provide for a complete project. No separate payment will be made for items not specifically called out in the Bid Form.

Payment for all Base Bid items included in the Bid Form shall be as stipulated in the Measurement & Payment section of the specifications.

Payment for all Alternates included in the Bid Form shall be as stipulated in the Measurement & Payment section of the specifications.

3.2 GENERAL

The total bid price for each item of the contract, whether Lump Sum or Unit Price, shall cover all work shown on the contract drawings and required by the specifications and other Contract Documents. All costs in connection with the work, including furnishing all materials, equipment, supplies and appurtenances; providing all construction plant, equipment, and tools; and performing all necessary labor and supervision to fully complete the work, shall be included in the unit and lump sum prices bid for all base bid items, alternatives and unit price items.

No item that is required by the Contract Documents for the proper and successful completion of the work will be paid for outside of or in addition to the prices submitted in the bid.

3.3 INCIDENTALS

All work not specifically set forth as a pay item in the Bid Form shall be considered an incidental item and all costs in connection therewith shall be included in the price bid.

SECTION 01005 - SUMMARY, ALTERNATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division 1 Specification sections, apply to work of this section.

1.2 PROJECT/WORK IDENTIFICATION:

A. General: Name of project is "Centennial Park" on contract documents by the Landscape Architect, Carl Thuesen ASLA, 1925 Grand Avenue #105, Billings, MT 59102.

B. Contract Documents indicate the work to be carried out under a single prime Contract.

C. Summary by References: Work of Contract can be summarized by reference to the Contract, General Conditions, Supplementary Conditions, specification sections as listed in the "Index of Specification Sections" bound herewith, drawings as listed in "Schedule of Drawings", addenda and modifications to the contract documents issued subsequent to the initial printing of this project manual, and including but not necessarily limited to printed matter referenced by any of these. It is recognized that work of Contract is also unavoidably affected or influenced by governing regulations, natural phenomenon including weather conditions, and other forces outside the contract documents.

D. Abbreviated Written Summary: Briefly, and without force and effect upon contract documents, work of Contract can be summarized as follows:

1. The work consists of renovation and expansion of a park for the City of Helena, Montana.

2. The work includes:
   - Demolition of existing site features.
   - Earthwork
   - Trail construction
   - Parking lot construction
   - Fence construction
   - Athletic field construction
   - Utility installation
   - Landscaping installation
   - Seeding
   - Irrigation installation

1.3 ALTERATIONS AND COORDINATION:

A. General: The work of this Contract includes coordination of entire work of project, including preparation of general coordination drawings/diagrams/schedules, and control of site utilization; from the beginning of activity, through the project close-out and warranty periods.

B. Alterations: Where applicable, requirements of contract documents apply for alteration work in same manner as for new work. Refer to drawings for specific requirements of alteration work.

1.4 ALTERNATES:

A. Definitions: Alternates are defined as alternate products, materials, equipment, installations or systems for the work which may, at Owner's option and under terms established by Instructions to Bidders, be selected and recorded in the Contract (Owner-Contractor Agreement) to either supplement or displace corresponding basic requirements of contract documents.

B. General Provisions: A "Schedule of Alternates" is included at end of this section. Each alternate is defined by abbreviated language, recognizing that drawings and specification sections document the requirements. Coordination of related work as required to ensure that work affected by each selected alternate is complete and properly interfaced with work of alternates.

C. Notification: Immediately following award of Contract prepare and distribute to each entity to be involved in performance of the work, a notification of status of each alternate.

1.5 MISCELLANEOUS AND GENERAL PROVISIONS

Cutting and Patching:

1. Definition: Includes cutting and patching of both previously existing work and nominally completed portions of Contract work. Excludes shop fabrication of work, and normal installation procedures including the drilling of holes to install fasteners. Excludes special categories of work identified as alterations, demolition, excavating, grading, planting, cleaning, removal/replacement of noncomplying work and similar activities; although some of these activities may require cutting and patching.

2. General: Specific requirements and limitations for cutting and patching are shown and specified for certain types of work, and specified in other sections of Division 1 as required quality control procedures for general application to performance of the work.

PART 2 - PRODUCTS (not applicable)

PART 3 - EXECUTION (not applicable)

PART 4 - ALTERNATES

4.1 SCHEDULE OF ALTERNATES:

A. Contractors: Submit with their proposals the amount to be added to their Base Proposal for the following Alternates. Include any modification of adjacent work that Contractor may be required to perform by reason of acceptance of Alternate.

B. All work required by Alternates: Completed in strict accordance with drawings, applicable sections of this specification.

C. ALTERNATES:

1. ALTERNATE NO. A1 HDPE WATER AND SEWER SERVICE LINES

Water and sewer service to the future Bouldering Area, Dog Park Area, and Freeride Park Area is not included in the Base Bid.

For Alternate No. A1, propose a price to install HDPE water service line to the Bouldering Area, Dog Park Area, and Freeride Park Area and an HDPE sewer service line to the Dog Park Area, and Freeride Park Area in sizes and classes indicated on the drawings and in the contract documents as "Additive Alternate 1".

2. ALTERNATE NO. A2 SOFTBALL INFIELD DRAINAGE

Installation of the softball infield drainage is not included in the Base Bid.

For Alternate No. A2, propose a price to install the softball infield drainage at three softball fields as indicated on the drawings and specifications.

3. ALTERNATE NO. A3 FERTILIZER

Application of fertilizer at irrigated turf areas is not included in the Base Bid.

For Alternate No. A3, propose a price to apply 16-25-12 with Poly-S Nitrogen at all irrigated turf areas. Manufacture: Anderson Golf Products. Application rate: 4.0 lbs./1,000 ft^2.

4. ALTERNATE NO. A4 SPLIT RAIL FENCING

Split rail fencing is not included in the Base Bid.

For Alternate No. A5, propose a price to install cedar split post and rail (2 rail) fencing as indicated on drawings. Material for fencing shall be as follows:

- Material: Western Red Cedar
- Posts (2 rail): Standard weight, 5'-4" minimum, bury depth: 24" minimum.
- Rails: Standard weight, 8'.

Provide informational submittal on material, dimensions, and installation procedures prior to beginning work.

5. ALTERNATE NO. A5 DECOMPOSED GRANITE TRAIL

The 4'-0" wide decomposed granite trails shown parallel to the asphalt trail is not included in the Base Bid.

For Alternate No. A6, propose a price to construct a 4'-0" wide decomposed granite trail parallel to asphalt trail as shown on the drawings.

6. ALTERNATE NO. A6 ELECTRICAL CONDUIT

Conduit and ground mount boxes for future electrical service to the Pavilion, Bouldering Area, Dog Park, and Freeride Park is not included in the Based Bid

For Alternate No. A6, propose a price to install conduit and ground mount boxes to the Pavilion, Bouldering Area, Dog Park, and Freeride Park in locations indicated on drawings.

7. ALTERNATE NO. A7 ELECTRICAL SERVICE

Electrical service to the future Pavilion, Bouldering Area, Dog Park, and Freeride Park is not included in the Base Bid.

For Alternate No. A7, propose a price to install direct bury electrical service to the Pavilion, Bouldering Area, Dog Park, and Freeride Park in locations indicated on drawings.

8. ALTERNATE NO. A8 ELECTRICAL CONDUIT FOR LIGHTING

Conduit for lighting is not included in the Base Bid.

For Alternate No. A8, propose a price to install conduit for lighting as indicated on the drawings and labeled "Alternate A8".

9. ALTERNATE NO. A9 ELECTRICAL CONDUIT FOR LIGHTING

Conduit for lighting is not included in the Base Bid.

For Alternate No. A9, propose a price to install conduit for lighting as indicated on the drawings and labeled "Alternate A9".

10. ALTERNATE NO. A10 LIGHTING

Lighting is not included in the Base Bid.

For Alternate No. A10, propose a price to install lighting and associated direct bury electrical service as indicated on the drawings and labeled "Alternate A10".

11. ALTERNATE NO. A11 LIGHTING

Lighting is not included in the Base Bid.

For Alternate No. A11, propose a price to install lighting and associated electrical service as indicated on the drawings and labeled "Alternate A11".

END OF SECTION 01005

SECTION 01068 - DEFINITIONS AND STANDARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division 1 Specification sections, apply to work of this section.

1.2 DEFINITIONS:

A. General Explanation: A substantial amount of specification language constitutes definitions for terms found in other contract documents, including drawings which must be recognized as diagrammatic in nature and not completely descriptive of requirements indicated thereon. Certain terms used in contract documents are defined generally in this article. Definitions and explanations of this section are not necessarily either complete or exclusive, but are general for the work to extent not stated more explicitly in another provision of contract documents.

1. General Requirements: The provisions or requirements of Division 1 sections. General Requirements apply to entire work of Contract and, where so indicated, to other elements which are included in project.

2. Indicated: The term "Indicated" is a cross-reference to details, notes or schedules on drawings, to other paragraphs or schedules in the specifications, and to similar means of recording requirements in contract documents. Where terms such as "shown," "noted," "scheduled," and "specified" are used in lieu of "indicated," it is for purpose of helping reader locate cross-reference, and no limitation of location is intended except as specifically noted.

3. Directed, Requested, etc.: Where not otherwise explained, terms such as "directed," "requested," "authorized," "selected," "approved," "required," "accepted," and "permitted" mean "directed by Architect/Engineer," "requested by Architect/Engineer," etc. However, no such implied meaning will be interpreted to extend Architect's/Engineer's responsibility into Contractor's area of construction supervision.

4. Approve: Where used in conjunction with Architect's/Engineer's response to submittals, requests, applications, inquiries, reports and claims by Contractor, the meaning of term "approved" will be held to limitations of Architect's/Engineer's responsibilities and duties as specified in General and Supplementary Conditions. In no case will "approval" by Architect/Engineer be interpreted as a release of Contractor from responsibilities to fulfill requirements of contract documents.

5. Project Site: The space available to Contractor for performance of the work, either exclusively or in conjunction with others performing other work as part of the project. The extent of project site is shown on drawings, and may or may not be identical with description of land upon which project is to be built.

6. Furnish: Except as otherwise defined in greater detail, term "furnish" is used to mean supply and deliver to project site, ready for unloading, unpacking, assembly, installation, etc., as applicable in each instance.

7. Install: Except as otherwise defined in greater detail, term "install" is used to describe operations at project site including unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing protecting, cleaning and similar operations, as applicable in each instance.

8. Provide: Except as otherwise defined in greater detail, term "provide" means furnish and install, complete and ready for intended use, as applicable in each instance.

9. Installer: The entity (person or first engaged by Contractor or its subcontractor or sub-subcontractor for performance of a particular unit of work at project site, including installation, erection, application and similar required operations. It is a general requirement that such entities (Installers) be expert in operations they are engaged to perform.

10. Testing Laboratory: An independent entity engaged to perform specific inspections or tests of the work, either at project site or elsewhere; and to report and (if required) interpret results of those inspections or tests.

11. Owner's Representative: Architect/Engineer.

1.3 FORMAT AND SPECIFICATION EXPLANATIONS:

A. Specification Production: None of these explanations will be interpreted to modify substance of requirements. Portions of these specifications have been produced by Architect's/Engineer's standard methods of editing master specifications, and may contain minor deviations from traditional writing formats. Such deviations are a normal result of this production technique. and no other meaning will be implied or permitted.

B. Format Explanation: The format of principal portions of these specifications can be described as follows; although other portions may not fully comply and no particular significance will be attached to such compliance or non-compliance:

Sections and Divisions: For convenience, basic unit of specification text is a "section," each unit of which is named and numbered. These are organized into related families of sections, and various families of sections are organized into "divisions," which are recognized as the present industry-consensus on uniform organization and sequencing of specifications. The section title is not intended to limit meaning or content of section, nor to be fully descriptive of requirements specified therein, nor to be an integral part of text.

C. Overlapping and Conflicting Requirements: Where compliance with 2 or more standards or sets of requirements is specified, or drawn and overlapping of those different standards or requirements establishes different or conflicting minimums or levels of quality, most stringent requirement (which is generally recognized to be also most costly) is intended and will be enforced, unless specifically detailed language written into contract documents (not by way of reference to an industry standard) clearly indicates that a less stringent requirement is to be fulfilled. Refer apparently-equal-but-different requirements, and uncertainties as to which level of quality is more stringent, to Architect/Engineer for a decision before proceeding.

Contractor's Options: Except for overlapping or conflicting requirements, where more than one set of requirements are specified for a particular unit of work, option is intended to be Contractor's regardless of whether specifically indicated as such.

D. Minimum Quality/Quantity: In every instance, quality level or quantity shown or specified is intended as minimum for the work to be performed or provided. Except as otherwise specifically indicated, actual work may either comply exactly with that minimum (within specified tolerances), or may exceed that minimum within reasonable limits. In complying with requirements, indicated numeric values are either minimums or maximums as noted or as appropriate for context of requirements. Refer instances of uncertainty to Architect/Engineer for decision before proceeding.

E. Trades: Except as otherwise indicated, the use of titles such as "carpentry" in specification text, implies neither that the work must be performed by an accredited or unionized tradesperson of corresponding generic name (such as "carpenter"), nor that specified requirements apply exclusively to work by tradesperson of that corresponding generic name.

F. Abbreviations: The language of specifications and other contract documents is of the abbreviated type in certain instances, and implies words and meanings which will be appropriately interpreted. Actual word abbreviations of a self-explanatory nature have been included in texts. Specific abbreviations have been established, principally for lengthy technical terminology and primarily in conjunction with coordination of specification requirements with notations on drawings and in schedules. These are frequently defined in section at first instance of use. Trade association names and titles of general standards are frequently abbreviated. Singular words will be interpreted as plural and plural words will be interpreted as singular where applicable and where full context of the contract documents so indicates.

1.4 DRAWING SYMBOLS:

General: Except as otherwise indicated, graphic symbols used on drawings are those symbols recognized in the construction industry for purposes indicated. Refer instances of uncertainty to Architect/Engineer before proceeding.

1.5 INDUSTRY STANDARDS:

A. General Applicability of Standards: Applicable standards of construction industry have same force and effect (and are made a part of contract documents by reference) as if copied directly into contract documents, or as if published copies were bound herewith.

1. Referenced standards (referenced directly in contract documents or by governing regulations) have precedence over non-referenced standards which are recognized in industry for applicability to work.

2. Non-referenced standards recognized in the construction industry are hereby defined, except as otherwise limited in contract documents, to have direct applicability to the work, and will be so enforced for performance of the work.

B. Publication Dates: Except as otherwise indicated, where compliance with an industry standard is required, comply with standard in effect as of date of contract documents.

C. Abbreviations and Names: Where acronyms or abbreviations are used in specifications or other contract documents they are defined to mean the industry recognized name of trade association, standards generating organization, governing authority or other applicable to context of text provision. Refer to "Encyclopedia of Associations," published by Gale Research Co.

D. Abbreviations and Names: The following acronyms or abbreviations as referenced in contract documents are defined to mean the associated names. Both names and addresses are subject to change, and are believed to be, but are not assured to be, accurate and up-to-date as of date of contract documents:

AA	Aluminum Association 818 Connecticut Ave. NW; Washington DC 20006: 202/862-5100
AAMA	Architectural Aluminum Manufacturers Association 35 E. Wacker Drive; Chicago, IL 60601; 312/782-8256
ACI	American Concrete Institute Box 19150; Detroit, MI 48219; 313/532-2600
ACIL	American Council of Independent Laboratories 1725 K Street, NW; Washington, DC 20006; 202/659-3766
AGA	American Gas Association 1515 Wilson Blvd.; Arlington, VA 22209; 703/841-8400
AIA	American Institute of Architects 1735 New York Ave. NW; Washington, DC 20006; 202/626-7474
AISC	American Institute of Steel Construction, Inc. 400 N. Michigan Ave.; Chicago, IL 60611: 312/670-2400
AITC	American Institute of Timber Construction 333 W Hampden Ave.; Englewood, CO 80110; 303/761-3212
ANSI	American National Standards Institute 1430 Broadway; New York, NY 10018; 212/354-3300
APA	American Plywood Association P.O. Box 11700; Tacoma, WA 98411; 206/565-6600
ASGCA	American Society of Golf Course Architects 221 N. LaSalle St., Chicago, IL 60601; 312/372-7090
ASHRAE	American Society of Heating, Refrigerating & Air-Conditioning Engineers 1791 Tullie Circle, NE; Atlanta, GA 30329: 404/636-8400
ASLA	American Society of Landscape Architects 1733 Connecticut Ave., N. W. Washington, DC 20009; 202/466-7730
ASME	American Society of Mechanical Engineers 345 East 47th St.; New York, NY 10017; 212/705-7722

ASTM	American Society for Testing and Materials 1916 Race St.; Philadelphia, PA 19103; 215/299-5400
AWI	Architectural Woodwork Institute 2310 S. Walter Reed Dr.; Arlington, VA 22206; 703/671-9100
AWPA	American Wood-Preservers' Association 7735 Old Georgetown Rd.; Bethesda, MD 20814; 301/652-3109
AWPB	American Wood Preservers Bureau P.O. Box 6085; Arlington, VA 22206: 703/931-8180
AWS	American Welding Society P.O. Box 351040; Miami, FL 33135; 305/642-7090
CRSI	Concrete Reinforcing Steel Institute 933 Plum Grove Rd.; Schaumburg, IL 60195; 312/372-5059
CS	Commercial Standard of NBS (US Dept. of Commerce) Government Printing Office; Washington DC 20402
FHA	Federal Housing Administration (U.S. Dept. of HUD) 451 - 7th St. SW; Washington, DC 20201
FM	Factory Mutual Engineering Corp. 1151 Boston-Providence Turnpike; Norwood, MA 02062 617/762-4300
FS	Federal Specification (General Services Admin.) Bldg. 197, Washington Navy Yard SE; Washington DC 20407
GA	Gypsum Association 1603 Orrington Ave.; Evanston; IL 60201; 312/491-1744
GCSAA	Golf Course Superintendents Association of America 1617 St. Andrews Drive, Lawrence, KS 66046; 913/841-2240
IES	Illuminating Engineering Society of North America 345 E. 47th St.: New York NY 10017; 212/644-7926
NAAMM	National Association of Architectural Metal Mfrs. 221 N. La Salle St.; Chicago, IL 60601; 312/346-1600
NBS	National Bureau of Standards (U.S. Dept. of Commerce) Gaithersburg, MD 20234; 301/921-1000
NEC	National Electrical Code (by NFPA)
NEMA	National Electrical Manufacturers Association 2101 L St. NW; Washington DC 20037; 202/457-8400
NFPA	National Fire Protection Association 470 Atlantic Ave.; Boston MA 02210; 617/482-8755

NHLA	National Hardwood Lumber Association P.O. Box 34518; Memphis, TN 38104: 901/377-1818
NPA	National Particleboard Association 2306 Perkins Pl.; Silver Spring, MD 20910; 301/587-2204
NWMA	National Woodwork Manufacturers Association 205 West Touhy Ave.; Park Ridge, IL 60068; 312/823-6747
OSHA	Occupational Safety & Health Administration (U.S. Dept. of Labor) Government Printing Office: Washington, DC 20402
SD.I.	Steel Door Institute 712 Lakewood Cnt. N.; Cleveland, OH 44107; 216/226-7700
SIGMA	Sealed Insulating Glass Manufacturers Association 111 E. Wacker Dr.; Chicago, IL 60601; 312/644-6610
SMACNA	Sheet Metal & Air Conditioning Contractors' National Association P.O. Box 70; Merrifield, VA 22116
SPIB	Southern Pine Inspection Bureau (Grading Rules) 4709 Scenic Hgy.; Pensacola, FL 32504; 904/434-2611
TIMA	Thermal Insulation Manufacturers Association 7 Kirby Plaza: Mt. Kisco, NY 10549: 914/241-2284
TPI	Truss Plate Institute 100 W. Church St.; Frederick, MD 21701; 301/694-6100
UL	Underwriters Laboratories 333 Pfingsten Rd., Northbrook, IL 60062: 312/272-8800
WCLIB	West Coast Lumber Inspection Bureau (Grading Rules) PO Box 23145; Portland, OR 97223; 503/639-0651
WRI	Wire Reinforcement Institute 7900 Westpark Drive; McLean, VA 22102: 703/790-9790
WWPA	Western Wood Products Association (Grading Rules) 1500 Yeon Blg.: Portland, OR 97204: 503/224-3930
W.W.P.A.	Woven Wire Products Association 108 W. Lake St.; Chicago, IL 60601; 312/332-6502

1.6 SUBMITTALS:

Permits, Licenses and Certificates: For the Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, and similar documents, correspondence and records established in conjunction with compliance with standards and regulations bearing upon performance of the work.

PART 2 - PRODUCTS (not applicable)

PART 3 - EXECUTION (not applicable)

END OF SECTION 01068

SECTION 01155 - SCHEDULES, REPORTS, PAYMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division 1 Specification sections, apply to work of this section.

1.2 COORDINATION:

Coordinate timing and the listing of reports/activities required. In particular, provide close coordination of progress schedule, schedule of values, listing of subcontracts, schedule of submittals, progress reports, and payment requests.

1.3 PROGRESS SCHEDULE:

A. Bar-Chart Schedule: Within 5 days after contract award, submit a comprehensive bar-chart type progress schedule indicating (by stage-coded symbols) a time bar for each major category or unit of work to be performed at site, and including minor units which are, nevertheless, involved in overall sequencing of the work. Arrange schedule to graphically show major sequences required in intermeshing of work, and to show how substantial completion is scheduled to allow for Architect's certification thereto. Prepare and maintain schedule on sufficiently wide sheet or series of sheets, of stable transparency or other reproducible stock, to show required data clearly for entire Construction Time, and to permit reproduction for required distribution.

1. Individual Work Stages: By uniform targeted symbols and cross-hatched bars, show significant stages for each category or unit of work, including (where applicable), but not necessarily limited to, subcontract letting, submittals, purchases, mock-ups, fabrication, sample testing, deliveries, installation, testing, adjusting, curing, start up and placement into final use and operation. As each unit of work progresses, mark each bar with a contrasting mark to show actual percentage-of-completion.

2. Area Separations: Arrange schedule with an individual time bar for each major area of construction of each major category or unit of work where it must be sequenced or intermeshed with other work as needed for structural completion, permanent space enclosure, and completion of mechanical/electrical work for overall work in that area.

3. Cost Correlation: Immediately below date line at heading of chart, provide a double-line cost correlation line ("precalculated" and "actual") to show dollar-volume of work performed as of same dates used for preparation of payment requests. Refer to subsequent article for cost reporting and payment procedures. Use those same dates as primary vertical lines of schedule. In so far as it is practical to do so, use same units of work in progress schedule as indicated in the "schedule of values" required by General Conditions and further specified herein.

Superimpose an S-curve on schedule (only first sheet for multiple-sheet schedule) to show "precalculated" dollar-volume against time at any point during Contract Time; with a double column of figures in left-hand margin

ranging from zero dollars to Contract Sum, and from zero percent to 100. As work progresses and on each date used in payment requests, plot a second S-curve showing "actual" dollar-volume of work performed.

4. Distribution: Following initial submittal to and response by Architect/Engineer, print and distribute progress schedule to Architect/Engineer (2 copies). Owner, separate contractors (if any), principal subcontractors and suppliers or fabricators, and others with a need-to-know schedule-compliance requirement. Post copies in field (temporary) offices. Distribute and post subsequent updated issues to same entities, when revisions are made; except delete entities from distribution when they have completed assigned work and are no longer involved in performance of scheduled work.

B. CPM progress scheduling or other approved methods may be substituted for bar-chart specified, at Contractor's option, subject to approval by Architect/Engineer.

1.4 PRE-CONSTRUCTION CONFERENCE:

A. The Architect shall schedule a pre-construction meeting as soon after contract award as possible. This meeting shall be attended by representatives of the Owner, the Contractor, the major subcontractors, and the Architect/Engineer.

B. Purpose of meeting will be to review each entity's present and future needs, discuss proposed work schedules, and requirements of the contract documents.

1.5 SCHEDULE OF VALUES:

A. General: Prepare schedule of values, as required by General Conditions, in coordination with preparation of progress schedule. Correlate line items with other administrative schedules and forms required for the work, including progress schedule, payment request form, listing of subcontractors, schedule of alternates, listing of products and principal suppliers and fabricators. Provide breakdown of Contract Sum in sufficient detail to facilitate continued evaluation of payment requests and progress reports. Break down principal subcontract amounts into several line items. Round off to nearest whole dollar, but with total equal to Contract Sum. Submit 3 copies of schedule of values to Architect/Engineer.

B. Time Coordination: In coordination of initial submittals and other administrative "start-up" activities, submit schedule of values to Architect/Engineer at earliest feasible date, but in no case later than 7 days before initial payment request is to be submitted.

C. Listing: Arrange schedule with columns to indicate generic name of item, related specification sections, subcontractor, supplier/manufacturer/fabricator, change orders (numbers) which have affected value, dollar value of item, and percentage of Contract Sum (to nearest one-hundredth percent and adjusted to total 100 percent).

D. Margins of Cost: Show line items of indirect costs, and margins on actual costs, only to extent such items will be individually listed in payment requests. In general, establish each item in schedule of values (and in payment requests) to be complete with its total expenses and proportionate share of general overhead and profit margin. Except as otherwise indicated, major cost items, which are not directly cost of actual work-in-place, such as distinct temporary facilities, may be either shown as line items in schedule of values or distributed as general overhead expense, at Contractor's option.

E. Schedule Updating: Update and resubmit schedule of values only if actual performance of the work involves necessary changes of substance to values previously listed. Submit approved change order amounts as a new line item.

1.6 PAYMENT REQUESTS:

A. General: Except as otherwise indicated, sequence of progress payments is to be regular, and each must be consistent with previous applications and payments. It is recognized that certain applications involve extra requirements, including initial application, application at times of substantial completion, and final payment application.

B. Payment Application Times: The date for each progress payment is indicated in Owner-Contractor Agreement. The period of construction work covered by each payment request is period indicated in Owner-Contractor Agreement.

C. Payment Application Forms: Use forms provided in this specification. Copies available from the Architect.

D. Application Preparation: Except as otherwise indicated, complete every entry provided for on the form, including notarization and execution by authorized persons. Incomplete applications will be returned by Architect/Engineer without action. Entries must match current data of schedule of values and progress schedule and report.

E. Initial Payment Application: The principal administrative actions and submittals which must precede or coincide with submittal of first payment application can be summarized as follows, but not necessarily by way of limitation:

Listing of subcontractors and principal suppliers and fabricators.

Schedule of values.

Progress schedule (preliminary if not final).

Schedule of principal products and manufacturers.

Copies of acquired building permits and similar authorizations and licenses from governing authorities for current performance of the work.

F. Final Payment Application: The administrative actions and submittals which must precede or coincide with submittal of final payment application can be summarized as follows, but not necessarily by way of limitation:

1. Warranties (guarantees), maintenance agreements and similar provisions of contract documents.

2. Test/adjust/balance records, maintenance instructions, meter readings, start-up performance reports, and similar change-over information germane to Owner's occupancy, use, operation and maintenance of completed work.

3. Completion of project closeout requirements.

4. Completion of items specified for completion beyond time of substantial completion.

5. Removal of temporary facilities, services, surplus materials, rubbish and similar elements.

6. Change over of door locks and other Contractor's access provisions to Owner's property.

7. Consent of surety for final payment and payment certifications.

8. Affidavit of payment of debts & claims.

9. Affidavit of release of liens.

G. Application Transmittal: Submit 3 executed copies of each payment application.

END OF SECTION 01155

SECTION 01205 - PROCEDURES AND CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division 1 Specification sections, apply to work of this section.

1.2 DESCRIPTION OF WORK:

The types of minimum requirements for procedures and performance or control work of a general nature include but are not necessarily limited to the following categories:

Coordination and meetings.
Administrative/supervisory personnel.
Surveys and records or reports.
Limitations for use of site.
Special reports.
Tradespeople and workmanship standards.
Inspections, tests and reports.
General installation provisions.
Cutting and patching.
Cleaning and protection.
Conservation and salvage.

1.3 COORDINATION AND MEETINGS:

A. General: Contractor shall prepare a written memorandum of general instructions on required coordination activities including notices/reports/meetings, and shall distribute memorandum to each major subcontractor, and to each other separate contractor where interfacing of work is required.

B. Monthly Coordination Meeting: In addition to specific preinstallation meetings and coordination meetings for each major element of work, Contractor shall schedule and hold monthly general project coordination meetings. Require representation at meeting by every major subcontractor currently involved in the Work. Conduct meetings in a manner which will resolve coordination problems. Record results of meetings and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.

1.4 ADMINISTRATIVE/SUPERVISORY PERSONNEL:

A. General: In addition to a General Superintendent and other administrative and supervisory personnel required for performance of the work, provide specific coordinating personnel as specified herein.

B. Project Coordinator: Provide a Project Coordinator who is experienced in administration and supervision of site work construction including mechanical and electrical work, and who is hereby authorized to act as the general coordinator of all subcontractors and phases of work.

1.5 SURVEYS AND RECORDS/REPORTS:

Establish and maintain bench marks and other dependable markers to set lines and levels for the work as needed to properly locate each element of entire project. Calculate, measure and verify that required dimensions are correct as shown. Advise Architect promptly upon detection of any deviations.

1.6 LIMITATIONS FOR USE OF SITE:

A. General: In addition to site utilization limitations and requirements shown on drawings, and indicated by other contract documents, administer allocation of available space equitably among entities needing access and space, so as to produce best overall efficiency in performance of total work of project. Schedule deliveries so as to minimize space and time requirements for storage of materials and equipment on site.

B. Construction Personnel Parking: Contractor shall advise all employees, subcontractors and other entities that parking must occur only on the immediate project site.

C. Disposal of Waste Materials: Do not dispose of waste materials on the site, either by burial or burning.

1.7 INSPECTIONS, TESTS AND REPORT:

A. General: Required inspection and testing services are intended to assist in determination of probable compliances of work with requirements, but do not relieve Contractor of responsibility for those compliances, or for general fulfillment of requirements of contract documents. Specified inspections and tests are not intended to limit Contractor's quality control program. Afford reasonable access to agencies performing tests and inspections.

B. Owner's Tests: Where tests or inspections are indicated as Owner's responsibility, Owner will engage independent testing agency to perform required services.

Contractor shall pay for all retests to meet standards specified; be responsible for and pay cost of delivery of test samples to agency's laboratory. Advise Architect promptly upon detection of any deviations.

C. Where tests are indicated as Contractor's responsibility, engage independent commercial testing laboratory; pay for all tests, retests and test sample delivery costs.

D. Reports: Submit test/inspection reports, in duplicate to Architect/Engineer except as otherwise indicated.

PART 2 - PRODUCTS (not applicable)

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION PROVISIONS:

A. Installer's Inspection of Conditions: Require Installer of each major unit of work to inspect substrate to receive work, and conditions under which work will be performed,

and to report (in writing) unsatisfactory conditions. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to Installer.

B. Manufacturer's Instructions: Where installations include manufactured products, comply with manufacturer's applicable instructions and recommendations for installation, to extent these are more explicit or more stringent than requirements indicated in contract documents.

C. Inspect each item of materials or equipment immediately prior to installation, and reject damaged and defective items.

D. Provide attachment and connection devices and methods of securing work properly as it is installed; true to line and level, and within recognized industry tolerances if not otherwise indicated. Allow for expansions and movements. Provide uniform joint widths in exposed work, organized for best possible visual effect. Refer questionable visual-effect choices to Architect for final decision.

E. Recheck measurements and dimensions of the work, as an integral step of starting each installation.

F. Install work-during conditions of temperature, humidity, exposure, forecasted weather, and status of project completion which will ensure best possible results for each unit of work, in coordination with entire work. Isolate each unit of work from non-compatible work, as required to prevent deterioration.

G. Coordinate enclosure of work with required inspections and tests, so as to minimize necessity of uncovering work for that purpose.

H. Mounting Heights: Where mounting heights are not indicated, mount individual units of work at industry-recognized standard mounting heights for applications indicated. Refer questionable mounting height choices to Architect/Engineer for final decision.

3.2 CUTTING AND PATCHING

A. General: Submit proposed cutting and patching to Architect/Engineer for approval before proceeding. Do not cut-and-patch operational elements and safety-related components in a manner resulting in reduction of capacities to perform in manner intended or resulting in decreased operational life, increased maintenance, or decreased safety.

Do not cut-and-patch work which is exposed on exterior or exposed in occupied spaces, in a manner resulting in reduction of visual qualities or resulting in substantial evidence of cut-and-patch work, both as judged solely by Architect. Remove and replace work judged by Architect to be cut-and-patched in a visually unsatisfactory or otherwise objectionable manner.

B. Materials: Except as otherwise indicated or approved by Architect/Engineer, provide materials for cutting-and-patching which will result in equal-or-better work than work being cut-and-patched; in terms of performance characteristics and including visual effect where applicable. Use materials identical with original materials where feasible and where recognized that satisfactory results can be produced thereby.

C. Temporary Support and Protection: Provide adequate temporary support for work to be cut, to prevent failure. Do not endanger other work. Provide adequate protection of other work during cutting and patching, to prevent damage; and provide protection of the work from adverse weather exposure.

D. Cut work by methods least likely to damage work to be retained and work adjoining.

1. Where physical cutting action is required, cut work with sawing and grinding tools, not with hammering and chopping tools. Core drill openings through concrete work.

2. Comply with the requirements of applicable sections of Division 2 where cutting-and-patching requires excavating and backfilling.

E. Patch with seams which are durable and as invisible as possible. Comply with specified tolerances for the work. Where feasible, inspect and test patched areas to demonstrate integrity of work.

F. Restore exposed finishes of patched areas; and, where necessary extend finish restoration onto retained work adjoining, in a manner which will eliminate evidence of patching.

3.3 CLEANING AND PROTECTION:

A. General: During handling and installation of work at project site clean and protect work in progress and adjoining work on a basis of perpetual maintenance. Apply suitable protective covering on newly installed work where reasonably required to ensure freedom from damage or deterioration at time of substantial completion; otherwise, clean and perform maintenance on newly installed work as frequently as necessary through remainder of construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

B. Limiting Exposure of Work: To extent possible through reasonable control and protection methods, supervise performance of work in a manner and by means which will ensure that none of the work, whether completed or in progress, will be subjected to harmful, dangerous, damaging, or otherwise deleterious exposures during construction period.

END OF SECTION 01205

SECTION 01275 - MEASUREMENT AND PAYMENT

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

Drawings and Special Provisions of the Contract, including General and Supplementary Conditions and other Division 1- Division16 Specification Sections, apply to this Section.

1.2 SUMMARY

This Section includes administrative and procedural requirements for measurement and payment.

1.3 DEFINITIONS

Unit price is an amount proposed by bidders, stated on the Bid Form, as a price per unit of measurement for materials or services added to or deducted from the Contract Sum by appropriate modification, if estimated quantities of Work required by the Contract Documents are increased or decreased.

1.4 PROCEDURES

A. Unit prices include all necessary material, plus cost for delivery, installation, insurance, overhead, and profit.

B. Measurement and Payment: The following description of work, measurement of pay quantities, and method of payment shall govern payment made to the Contractor. The total bid price for each item of the contract shall cover all work shown on the contract drawings and required by the specifications and other Contract Documents. All costs in connection with the work, including mobilization, furnishing all materials, equipment, supplies and appurtenances; providing all construction plant, equipment, and tools; and performing all necessary labor and supervision to fully complete the work, shall be included in the unit price bid. No item that is required by the Contract Documents for the proper and successful completion of the work will be paid for outside of or in addition to the prices submitted in the bid. All work not specifically set forth as a pay item in the Bid Form shall be considered a subsidiary obligation of the Contractor and all costs in connection therewith shall be included in the prices bid. All payments will be made at the Contract Unit Price.

C. Should the Owner desire to increase or decrease the scope of work, the unit prices bid shall be used to determine the costs associated with any such adjustments.

D. The Contractor shall bare the burden of proof for any quantities in excess of those provided on the Bid Form

E. List of Bid Items: A list of unit Bid Items is included at the end of this Section.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

PART 4 - MEASUREMENT AND PAYMENT

BID ITEM DESCRIPTION

01 MOBILIZATION:

1. Description: This item shall cover the costs of preparatory work and operations including, but not limited to, those necessary for the movement of personnel, equipment, supplies and incidentals to the project site; for the establishment of all facilities necessary for the work on the project; for the costs of obtaining the required permits, bonds, and insurance; and for all other work and operations which must be performed, or costs incurred prior to beginning work on the various items of the project. **Any bids that contain a lump sum bid price for mobilization greater than 10% of the bid price for the respective schedule or additive alternative may be rejected at the option of the Owner.**
2. Unit of Measurement: Lump Sum.
3. Measurement: When the percentage of the original Contract amount for each Unit shown below is earned, the percentage of the Contract Lump Sum price for MOBILIZATION shown below will be paid.

Percentage of Original Contract Amount In-Place	Percentage of Lump Sum Price for Mobilization Earned
5	20
10	50
25	60
65	75
90	90
100	100

4. Payment: Payment for MOBILIZATION will be made on the percentage of the contract unit price bid per lump sum as indicated in the Bid Form.

02 SITE CLEARING/DEMOLITION

1. Description: This item shall cover the costs associated with the removal and legal disposal of items indicated on the drawings and items that are in conflict with the proposed work.
2. Work Required: Work required under this section shall include but not be limited to the following:
   a. Clearing and Grubbing;
   b. Pavements removal;
   c. Curb and Gutter removal;
   d. Fence removal;
   e. Removal of selected landscape areas;
   f. Indicated sign removal;
   g. Light pole removal (incl. coordination with Northwestern Energy);
   h. Existing irrigation equipment.
   i. All labor, tools, equipment, materials, royalties, incidentals necessary to complete the work as specified in the drawings.
3. Unit of Measurement: LUMP SUM

4. Measurement: Not applicable
5. Payment: Payment for SITE DEMOLITION will be made at the contract unit price bid per lump sum as indicated in the Bid Form.

03 HERBICIDE APPLICATION AND DISKING

1. Description: This item covers the herbicide application and disking at the exiting turf areas and hillside adjacent to Lyndale Ave.
2. Work Required: Work required under this section includes but is not limited to the following:
   a. Application of herbicide.
   b. Disking of existing lawn/grass areas.
   c. All labor, tools, equipment, materials, and incidentals necessary to complete the work as specified.
3. Unit of Measurement: ACRE.
4. Measurement: per ACRE
5. Payment: Payment for HERBICIDE APPLICATION AND DISKING will be made at the contract unit price bid per ACRE sum as indicated in the Bid Form.

04 SITE GRADING

1. Description: This item shall cover site grading as indicated on the drawings and in the contract documents.
2. Work Required: Work required under this section shall include, but not be limited to the following;
   j. Clearing & grubbing;
   k. Subgrade proof rolling;
   l. Excavation, fill and compaction of on-site material;
   m. Subgrade grading;
   n. Disposal of excess or unsuitable material: All construction debris shall be disposed of off-site. No burning of materials on the project site will be allowed.
   o. Stockpiling excess materials to be used in fill areas;
   p. Supplying all necessary testing;
   q. Providing water for compaction of subgrade;
   r. Strip & stockpile topsoil;
   s. Temporary erosion control measures;
   t. Final grading, cleanup;
   u. All labor, tools, equipment, materials, royalties, incidentals necessary to complete the work as specified.
3. Unit of Measurement: bank CUBIC YARD
4. Measurement: per bank CUBIC YARD in-place
5. Payment: Payment for SITE GRADING will be made at the contract unit price bid per bank CUBIC YARD sum as indicated in the Bid Form

05 IMPORTED FILL

1. Description: This item includes import of suitable subgrade fill material, placement, compaction, and grading necessary for the construction of the embankments for the Centennial Park as shown on the plans. The Contractor will be responsible for providing all necessary testing outlined in the specifications.
2. Work Required: Work required under this section shall include, but not be limited to the following:
   a. Contour grading;

b. Furnishing, placing, grading, and compacting imported fill;
c. Excavation & embankment placement required to construct, shape and slope embankments, backslopes, cuts, subgrades, shoulders, ditches, etc. to lines and grades indicated on drawings;
d. Disposal of excess or unsuitable material: All construction debris shall be disposed of off-site. No burning of materials on the project site will be allowed;
e. Stockpiling excess materials to be used in embankment;
f. Supplying all necessary testing not provided by the Engineer;
g. Compacted embankment in lifts;
h. Providing water for compaction of subgrade;
i. Strip & stockpile topsoil;
j. Temporary erosion control measures;
k. Final grading, cleanup;
l. Sampling and chemical analysis as required by special provisions 2.23;
m. All labor, tools, equipment, materials, royalties, incidentals necessary to complete the work as specified.

3. Unit of Measurement: CUBIC YARD
4. Measurement: per bank CUBIC YARD in-place
5. Payment: Payment for IMPORTED FILL will be made at the contract unit price bid per bank CUBIC YARD sum as indicated in the Bid Form

06 TOPSOIL

1. Description: This item includes all import of suitable topsoil material, placement and grading necessary and as shown on the Drawings. The Contractor will be responsible for providing all necessary testing outlined in the specifications.
2. Work Required: Work required under this section shall include, but not be limited to the following:
   a. Furnishing, placing, and grading topsoil;
   b. Supplying all necessary testing;
   c. Temporary erosion control measures;
   d. Final grading, cleanup;
   e. Sampling and chemical analysis as required by special provisions 2.23;
   f. All labor, tools, equipment, materials, royalties, incidentals necessary to complete the work as specified.
3. Unit of Measurement: CUBIC YARD
4. Measurement: per bank CUBIC YARD in-place
5. Payment: Payment for TOPSOIL will be made at the contract unit price bid per bank CUBIC YARD sum as indicated in the Bid Form

07 CONSTRUCT POND

2. Description: This item includes furnishing and installing the PVC liner, outlet structure, piping, and misc items to construct the pond as illustrated in the detail(s) included in the Drawings
3. Work Required: Work required for this section includes but is not limited to the following.
   a. Excavation, backfill, and compaction;
   b. Furnishing and installing gravel, riprap, pvc liner, outlet structure, piping, etc. necessary to construct the pond;

c. Furnishing and installing all fittings and supports in the structure and fittings outside of the structure necessary to connect to the pond to the existing stormwater sewer;
d. Coating exposed metals;
e. All labor, tools, equipment, materials, royalties and incidentals necessary to complete the work as specified.

4. Unit of Measurement: LUMP SUM
5. Measurement: Measurement for the CONSTRUCT POND will be made by LUMP SUM.
6. Payment: Payment to CONSTRUCT POND will be made as LUMP SUM.

08 ADJUST MONITORING WELL ELEVATIONS

1. Description: Replace all existing monitoring well covers or well protectors and provide a full-mount cover as shown on the Drawings.
2. Work required under this section shall include but not be limited to the following:
   a. Provide submittals for materials;
   b. Furnishing and installing new flush mount covers;
   c. Furnish and install PVC monitoring well pipe and locking cap to adjust the new wells to grade;
   d. All labor, tools, equipment, materials, royalties, and incidentals necessary to complete the work as specified.
3. Unit of Measurement: EACH
4. Measurement: Measurement for ADJUST MONITORING WELL ELEVATIONS will be made per EACH as indicated in the Bid Form.
5. Payment: Payment for ADJUST MONITORING WELL ELEVATIONS will be made at the contract unit price bid per each as indicated in the Bid Form.

09 ADJUST MANHOLE/VAULT ELEVATIONS

1. Description: Adjust manhole and vault castings and covers as shown on the Drawings and provide and installing concrete adjusting rings as required to match final grade.
2. Work required under this section shall include but not be limited to the following:
   a. Provide submittals for materials;
   b. Furnishing and installing new castings and covers;
   c. Furnish and install new manhole sections;
   d. Furnish and install new concrete grade rings;
   e. All labor, tools, equipment, materials, royalties, and incidentals necessary to complete the work as specified.
3. Unit of Measurement: EACH
4. Measurement: Measurement for ADJUST MANHOLE/VAULT ELEVATIONS will be made per EACH as indicated in the Bid Form.
5. Payment: Payment for ADJUST MANHOLE/VAULT ELEVATIONS will be made at the contract unit price bid per each as indicated in the Bid Form.

10 DROP INLET

1. Description: This item includes furnishing and installing new drop inlets in sizes and types indicated on the Drawings and in the Contract Documents.

2. Work Required: Work required under this section includes but is not limited to the following.
   a. Excavation, backfill, and compaction;
   b. Dewatering, sheeting, and shoring required for installation;
   c. Any necessary bypass pumping to maintain storm sewer service;
   d. Removing and disposing of any existing manholes or structures being replaced;
   e. All coring or cutting required;
   f. Furnishing and installing concrete drop inlets with monolithic base, gaskets, coatings, grouted connections, and frame and grate where specified;
   g. Furnishing and installing grate and cover;
   h. Connecting drop inlet to piping;
   i. All labor, tools, equipment, materials, royalties, and incidentals necessary to complete the work as specified.
3. Unit of Measurement: EACH
4. Measurement: Measurement for DROP INLET will be made by numerical count.
5. Payment: Payment for DROP INLET will be made at the contract unit price bid per EACH.

11 HDPE STORM PIPING

1. Description: This item includes furnishing and installing storm sewer mains in sizes, types, and classes indicated on the Drawings and in the Contract Documents.
2. Work Required: Work required under this section includes but is not limited to the following.
   a. Traffic control;
   b. Excavation, backfill, and compaction;
   c. Dewatering, sheeting, and shoring required for installation;
   d. Furnishing and installing pipe with gaskets, lubricants, etc.;
   e. Furnishing and installing pipe bedding;
   f. Furnishing and installing detectable warning tape;
   g. Testing and cleaning;
   h. TV inspection;
   i. Maintaining service to all users; and
   j. All labor, tools, equipment, materials, royalties, and incidentals necessary to complete the work as specified.
3. Unit of Measurement: LINEAL FOOT
4. Measurement: Measurement for HDPE STORM PIPING will be made per lineal foot along the centerline of the pipe through all fittings.
5. Payment: Payment for HDPE STORM PIPING will be made at the contract unit price bid per LINEAL FOOT.

12 STORM SEWER MANHOLE

1. Description: This item includes furnishing and installing storm sewer manholes in sizes and types indicated on the Drawings and in the Contract Documents.
2. Work Required: Work required under this section includes but is not limited to the following.
   a. Excavation, backfill, and compaction;
   b. Dewatering, sheeting, and shoring required for installation;
   c. Any necessary bypass pumping to maintain storm sewer service;

d. Removing and disposing of any existing manholes or structures being replaced;
e. All coring or cutting required;
f. Furnishing and installing concrete manholes with monolithic base, gaskets, coatings, grouted connections, and frame and grate where specified;
g. Furnishing and installing inlet grate and cover;
h. Connecting manhole to piping;
i. All labor, tools, equipment, materials, royalties, and incidentals necessary to complete the work as specified.

3. Unit of Measurement: EACH
4. Measurement: Measurement for MANHOLE will be made by numerical count.
5. Payment: Payment for MANHOLE will be made at the contract unit price bid per EACH.

13 & 14 HDPE WATER SERVICE LINE

1. Description: HDPE water service line in sizes and classes indicated on the drawings and in the contract documents. Service line installation shall be by: 1) Removing pavement and/or gravel, trench excavation, line installation, trench backfill, and pavement and/or gravel restoration; or 2) Pushing or pulling the service line (method to be approved by Engineer) without destruction to surfacing; or 3) Combination of 1 and 2 or other method approved by the Engineer.
2. Work Required: Work required under this section shall include but not be limited to the following:
   a. Traffic control;
   b. Excavation and backfill;
   c. Dewatering, sheeting, and shoring required for installation;
   d. Furnishing and installing bedding;
   e. Testing, cleaning and disinfecting;
   f. Pushing or pulling service lines if applicable;
   g. Furnishing and installing polyethylene service line;
   h. Furnishing and installing caps on unused lines;
   i. Furnishing and installing 3" Dia. Schedule 40 PVC sleeves at locations shown on the drawings (no separate payment);
   j. Surface restoration (pavement and/or gravel); and,
   k. All labor, tools, equipment, materials, royalties, and incidentals necessary to complete the work as specified.
3. Unit of Measurement: Per LINEAL FOOT.
4. Measurement: Measurement for HDPE WATER SERVICE LINE will be measured per LINEAL FOOT along the centerline of the pipe through all valves, fittings, and appurtenances as indicated in the Bid Form.
5. Payment: Payment will be made at the contract price bid per LINEAL FOOT for the various sizes and classes of HDPE WATER SERVICE LINE as indicated in the Bid Form and shall include the cost of trench excavation, pipe bedding, backfill and surface restoration.

15 BLOWOUT VAULT

1. Description: This section shall include new blowoff vault tied into the new services. This item shall include up to twenty feet of appropriately sized water service line to connect the vault to the service lines.

2. Work Required: Work required under this section shall include but not be limited to the following:
   a. Dewatering, sheeting, and shoring;
   b. Excavation, bedding, backfill and compaction around the vault;
   c. Furnishing and installing new blowoff vault, pipe, and valves;
   d. Thrust and anchor blocking;
   e. Furnishing and installing polyethylene wrap;
   f. Furnishing and installing drain gravel;
   g. All labor, tools, equipment, materials, royalties, and incidentals necessary to complete the work as specified.
3. Unit of Measurement: Per EACH.
4. Measurement: BLOWOFF VAULT will be measured per EACH by numerical count.
5. Payment: Payment will be made at the contract unit price bid per EACH for BLOWOFF VAULT.

16 &24 WATER SERVICE CONNECTION

1. Description: This item shall include the connection of the new service line to the water main and connection of the new water service line to existing service line. It includes installation of a new service saddle, corporation stop, curb valve and box. 6-inch connections shall include a tee with one end capped, a valve and up to 15 feet of 6-inch ductile iron pipe with all required fittings as shown in the Drawing.
2. Work Required: Work required under this section shall include but not be limited to the following:
   a. Traffic control;
   b. Trench excavation, bedding, backfill, and compaction;
   c. Dewatering, sheeting, and shoring;
   d. Gravel removal and replacement in streets and private driveways;
   e. Furnishing and installing service clamps and corporation stops for water main;
   f. Tapping the new water main;
   g. Furnishing and installing curb valves and boxes;
   h. Furnishing and installing fittings to connect new service lines to existing service lines;
   i. All labor, tools, equipment, materials, royalties, and incidentals necessary to complete the work as specified.
3. Unit of Measurement: Per EACH.
4. Measurement: Measurement for WATER SERVICE CONNECTIONS will be measured per EACH by numerical count.
5. Payment: Payment will be made at the contract unit price bid per EACH by type and size of WATER SERVICE CONNECTION as specified in the Bid Form.

17 & 18 PRESSURE SEWER SERVICE

1. Description: This item includes furnishing and installing sewer service lines in sizes, types, and classes indicated on the Drawings and in the Contract Documents.
2. Work Required: Work required under this section includes but is not limited to the following.
   a. Excavation, backfill, and compaction;
   b. Dewatering, sheeting, and shoring required for installation;

c. Furnishing and installing in-line service tap on the existing sewer mains;
d. Connecting to service tap on sewer main;
e. Furnishing and installing sewer service line, transition gaskets, couplings, and adapters for existing pipe;
f. Connecting to existing service;
g. Furnishing and installing pipe bedding;
h. Repairing fences, lawns and other landscaped areas damaged by construction;
i. Furnishing and installing 3" Dia. Schedule 40 PVC sleeves at locations shown on the drawings (no separate payment);
j. Replacing damaged trees and bushes; and
k. All labor, tools, equipment, materials, royalties, and incidentals necessary to complete the work as specified.

3. Unit of Measurement: LINEAL FOOT
4. Measurement: Measurement for PRESSURE SEWER SERVICE will be made per LINEAL FOOT along the centerline of the pipe through all fittings.
5. Payment: Payment for the PRESSURE SEWER SERVICE will be made at the contract unit price bid per LINEAL FOOT.

19 6" FIRE HYDRANT W/ GATE VALVE

1. Description: This section shall include new six-inch fire hydrants with an auxiliary gate valve and box tied into the new and/or existing mains.
2. Work Required: Work required under this section shall include but not be limited to the following:
   a. Traffic control;
   b. Dewatering, sheeting, and shoring;
   c. Excavation, bedding, backfill and compaction around the hydrant;
   d. Furnishing and installing new six-inch fire hydrants (Mueller Super Centurion 250 O.A.E.), auxiliary gate valves, up to 100 lineal feet of 6-inch ductile iron pipe, 3-bollards, valve boxes and fittings;
   e. Thrust and anchor blocking;
   f. Connection to water main, existing or new;
   g. Furnishing and installing polyethylene wrap;
   h. Furnishing and installing drain gravel;
   i. All labor, tools, equipment, materials, royalties, and incidentals necessary to complete the work as specified.
3. Unit of Measurement: Per EACH.
4. Measurement: 6" FIRE HYDRANT WITH GATE VALVE will be measured per each and shall include all work and materials needed for installation, including furnishing and installing all necessary couplings. Pipe, tees and fittings will be measured and paid for separately. No additional measurement and payment will be made for fire hydrant installation when actual field conditions cause elevations and distances from the main to change from those indicated on the Drawings since the six-inch pipe to the hydrant is paid for separately.
5. Payment: Payment will be made at the contract unit price bid per EACH for 6" FIRE HYDRANT WITH GATE VALVE.

20 & 21 DRAIN DITCH

1. Description: Contractor shall construct all ditches as shown on the DRAWINGS. Contractor to insure positive drainage on all ditches to a minimum depth as identified in the typical section. Engineer may require a flood test to be done on ditches to test for positive drainage. No additional costs for flood test.
2. Work required under this section shall include but not be limited to the following:
   a. The Contractor to construct ditches where needed to provide positive drainage;
   b. No additional payment to move and reset mailbox's. Contractor to remove and neatly stock pile any fence, landscaping rock, etc. that may be in the way of constructing new ditch section.
   c. Contractor to furnish and install check dams in locations indicated on the plans.
   d. All labor, tools, equipment, materials, royalties, incidentals necessary to complete the work as specified.
3. Unit of Measurement: LINEAL FOOT
4. Measurement: Measurement for DRAIN DITCH will be per LINAL FOOT as indicated in the Bid Form and as shown on the plans.
5. Payment: Payment for DRAIN DITCH will be made at the contract unit price bid per LINEAL FOOT as indicated in the Bid Form.

22 & 23 CULVERTS

1. Description: This item shall meet the requirements of Section 02720 of the MPW Standard Specifications. Contractor shall install cross drains and approach pipes at the sizes and locations shown on the plans.
2. Work required under this section shall include but not be limited to the following:
   a. Furnishing, excavating, placement, and backfilling of the culverts at the locations shown on drawings;
   b. All labor, tools, equipment, materials, royalties, incidentals necessary to complete the work as specified.
3. Unit of Measurement: LINEAL FOOT
4. Measurement: Measurement for CULVERTS will be per LINEAL FOOT as indicated in the Bid Form and as shown on the plans.
5. Payment: Payment for CULVERTS will be made at the contract unit price bid per LINEALFOOT as indicated in the Bid Form.

25 WATER METER/PRV PIT

1. Description: This item shall include furnishing and installing meters, pressure reducing valve, and meter pit in the size as indicated on the plans and in the contract documents.
2. The Contractor shall be prepared to adapt to any service pipe size and type in order that the water meter and meter pit be installed properly to the new meter pit (inlet and outlet) and the connection to the existing service line.
3. Work Required: Work required under this section shall include but not be limited to the following:
   a. Trench excavation, bedding, geotextile fabric, backfill, and compaction;
   b. Salvage to the Owner existing valves and curb boxes on existing water services;

c. Dewatering, sheeting, and shoring;
d. Furnishing and installing fittings to connect service lines to the new meter pit and to the existing service lines;
e. Locating the existing service;
f. Furnishing and installing water meters (available from the City of Helena), PRV, valves, fittings, manhole, and appurtenances with meter pit and lid along with all accessories as outlined in the Specifications and detailed in the Plans;
g. All connections for a complete installation of the meter pit, including connecting to the existing service line;
h. Disinfection of water meter, fittings, piping, valves and accessories;
i. Owner notification as outlined in the Specifications;
j. Furnishing and installing remote read unit including wiring, conduit;
k. Furnishing to the Owner two (2) sets of lid keys/wrenches compatible with the meter pit lid locking device;
l. Visual leak test of water meter and connections; and,
m. All labor, tools, equipment, materials, royalties, and incidentals necessary to complete the work as specified.

4. Unit of Measurement: Per EACH.
5. Measurement: Measurement for WATER METER/PRV PIT shall be per EACH by numerical count.
6. Payment: Payment for WATER METER/PRV PIT shall be made at the contract unit price bid per each as specified in the Bid Form.

26 ASPHALT PAVEMENT

1. Description: This item shall meet the requirements of section 02510 of the MPW Standard Specifications. Unless otherwise approved by the Engineer, the plant mix shall consist of Type B aggregate using performance grade asphalt binder 58-28.
2. Work required under this section shall include but not be limited to the following:
   a. Providing job-mix formula submittal;
   b. Providing, furnishing, transporting, stockpiling, heating, drying, and screening of aggregate materials;
   c. Providing and placing Geogrid;
   d. Providing, placing, and compacting base course materials;
   e. Furnishing, handling, measuring, mixing and manipulating of asphalt concrete materials including asphalt cement;
   f. Furnishing and installing concrete transition strip as shown on the drawings;
   g. Hauling, placing, shaping, compacting and finishing of the paving mix;
   h. Compaction tests as specified herein;
   i. All striping as shown on the drawings;
   j. All labor, tools, equipment, materials, royalties and incidentals required to complete the work as specified.
3. Unit of Measurement: SQUARE FOOT
4. Measurement: Measurement for the ASPHALT PAVEMENT will be per SQUARE FOOT as indicated in the Bid Form to the neat lines and grade as shown on the plans.

5. Payment: Payment for the ASPHALT PAVEMENT will be made at the contract unit price per SQUARE FOOT as indicated in the Bid Form.

27 CURB AND GUTTER:

1. Description: This item shall meet the requirements of Section 02528 of the MPW Standard Specifications and be constructed to the sizes and locations shown on the drawings.
2. Work required under this section shall include but not be limited to the following:
   a. Excavation and embankment as required to place base course at required grade;
   b. Furnishing, installing and compacting crushed aggregate base course;
   c. Fine grading and preparation of base;
   d. Formwork;
   e. Furnishing and installing concrete and reinforcing steel;
   f. Furnishing concrete mix design;
   g. Taking and breaking cylinders and taking slump tests;
   h. Finishing and curing concrete;
   i. Installation of construction joints;
   j. All labor, tools, equipment, materials, royalties and incidentals required to complete the work as specified.
3. Unit of Measurement: LINEAL FOOT
4. Measurement: Measurement for CONCRETE CURB AND GUTTER will be per LINEAL FOOT as indicated in the Bid Form and as shown on the plans.
5. Payment: Payment for CONCRETE CURB AND GUTTER will be made at the contract unit price bid per LINEAL FOOT as indicated in the Bid Form.

28 LOOP ROAD/PARKING AREA SURFACING

1. Description: This item shall meet the requirements of Section 02235 of the MPW Standard Specifications. The size of material to be used on this project is listed on the Drawings.
2. Work required under this section shall include but not be limited to the following:
   a. Provide gradation and proctor tests for aggregate as required;
   b. Loading, hauling, and spreading the aggregate surface course material;
   c. Blending, watering and compacting;
   d. Finish grading to the lines and grade shown on the plans;
   e. All labor, tools, equipment, materials, royalties, incidentals necessary to complete the work as specified.
3. Unit of Measurement: SQUARE FOOT
4. Measurement: Measurement for LOOP ROAD/PARKING AREA SURFACING will be per SQUARE FOOT as indicated in the Bid Form and to the neat lines and grade as shown on the plans.
5. Payment: Payment for LOOP ROAD/PARKING AREA SURFACING will be made at the contract unit price bid per SQUARE FOOT as indicated in the Bid Form.

29 FIRE ACCESS ROAD AND CENTRAL FIELD AREA SURFACING

1. Description: This item shall meet the requirements of Section 02235 of the MPW Standard Specifications. The size of material to be used on this project is listed on the Drawings.
2. Work required under this section shall include but not be limited to the following:
   a. Providing and placing geogrid;
   b. Providing, placing, and compacting base course materials;
   c. Loading, hauling, and placing owner provided decomposed granite surface course material;
   d. Blending, watering and compacting;
   e. Finish grading to the lines and grade shown on the plans;
   f. All labor, tools, equipment, materials, royalties, incidentals necessary to complete the work as specified.
3. Unit of Measurement: SQUARE FOOT
4. Measurement: Measurement for FIRE ACCESS ROAD SURFACING will be per SQUARE FOOT as indicated in the Bid Form and to the neat lines and grade as shown on the plans.
5. Payment: Payment for FIRE ACCESS ROAD SURFACING will be made at the contract unit price bid per SQUARE FOOT as indicated in the Bid Form.

30 CONCRETE PEDISTRIAN CROSSING

1. Description: Contractor shall construct the cement concrete pedestrian crossings as shown on the DRAWINGS.
2. Work required under this section shall include but not be limited to the following:
   a. Providing concrete-mix formula submittal;
   b. Providing and placing reinforcing steel;
   c. Providing and placing Portland cement concrete;
   d. All excavation, fill and grading required
   e. All striping as shown on the drawings;
   f. All labor, tools, equipment, materials, royalties and incidentals required to complete the work as specified.
3. Unit of Measurement: EACH
4. Measurement: Measurement for the CONCRETE PEDISTRIAN CROSSING will be EACH as indicated in the Bid Form.
5. Payment: Payment for the CONCRETE PEDISTRIAN CROSSING will be made at the contract unit price per EACH as indicated in the Bid Form.

31 & 32 TRAILS

1. Description: Contractor shall construct all trails as shown on the DRAWINGS.
2. Work required under this section shall include but not be limited to the following:
   g. Excavation and embankment as required to place geogrid, base course, decomposed granite or asphalt pavements at required grades;
   h. Furnishing and installing geogrid;
   i. Construction of all required handicap accessible ramps;
   j. Furnishing, installing and compacting crushed aggregate base course;
   k. Fine grading and preparation of base;

l. Loading, hauling and installing owner provided decomposed granite surface;
m. Furnishing and installing asphalt pavement;
n. All labor, tools, equipment, materials, royalties and incidentals required to complete the work as specified.

3. Unit of Measurement: LINEAL FOOT
4. Measurement: Measurement for TRAILS will be per LINEAL FOOT as indicated in the Bid Form and as shown on the plans.
5. Payment: Payment for TRAILS will be made at the contract unit price bid per LINEAL FOOT as indicated in the Bid Form

33 & 34 BOLLARDS

1. Description: This item covers the installation of bollards as indicated on the Drawings.
2. Work Required: Work required under this section includes but is not limited to the following:
   a. All necessary prep work;
   b. Providing and installing removable bollards as per manufacturer's recommendations or as shown on the drawings; and,
   c. All labor, tools, equipment, materials, and incidentals necessary to complete the work as specified.
3. Unit of Measurement: EACH
4. Measurement: Measurement for BOLLARDS will be per EACH for each type as indicated in the Bid Form and as shown on the plans.
5. Payment: Payment will be made at the contract unit price bid per EACH.

35 SIGNS

1. Description: This item covers providing and installing signs as indicated on the Drawings.
2. Work Required: Work required under this section includes but is not limited to the following:
   a. All necessary prep work;
   b. Providing and installing signs including post and hardware at the locations shown on the drawings; and,
   c. All labor, tools, equipment, materials, and incidentals necessary to complete the work as specified.
3. Unit of Measurement: EACH
4. Measurement: Measurement for SIGNS will be per EACH as indicated in the Bid Form and as shown on the plans.
5. Payment: Payment will be made at the contract unit price bid per EACH.

36 EXCAVATED WASTE REMOVAL/DISPOSAL

1. Description: This item covers the removal and disposal of landfill waste if encountered within utility trenches, irrigation trenches, or other excavations.
2. Work Required: Work required under this section includes but is not limited to the following:
   a. Excavation, haul and disposal of landfill waste at the City Transfer Station;
   b. The Contractor shall notify the Engineer and Architect if waste is encountered in excavated areas;
   c. The Contractor shall document the locations of all waste encountered in excavations; and,

d. All labor, tools, equipment, materials, and incidentals necessary to complete the work as specified.

3. Unit of Measurement: TON
4. Measurement: Measurement for EXCAVATED WASTE REMOVAL/DISPOSAL will be per TON as indicated in the Bid Form and as shown on the plans.
5. Payment: Payment will be made at the contract unit price bid per TON.

37 SELECT FILL

1. Description: This item covers providing and placement of select fill material within trenches or excavations if waste is encountered.
2. Work Required: Work required under this section includes but is not limited to the following:
   a. Providing and installing select fill to replace the excavated waste material as shown on the drawings;
   b. The Contractor shall document the locations of all waste encountered in excavations; and,
   c. All labor, tools, equipment, materials, and incidentals necessary to complete the work as specified.
3. Unit of Measurement: CUBIC YARD
4. Measurement: Measurement for SELECT FILL will be per bank CUBIC YARD in-place as indicated in the Bid Form.
5. Payment: Payment will be made at the contract unit price bid per CUBIC YARD.

38 ¾" MINUS FILL

1. Description: This item covers providing and placement of ¾" MINUS FILL material within trenches or excavations if waste is encountered.
2. Work Required: Work required under this section includes but is not limited to the following:
   a. Providing and installing select fill to replace the excavated waste material as shown on the drawings;
   b. The Contractor shall document the locations of all waste encountered in excavations; and,
   c. All labor, tools, equipment, materials, and incidentals necessary to complete the work as specified.
3. Unit of Measurement: CUBIC YARD
4. Measurement: Measurement for ¾" MINUS FILL will be per bank CUBIC YARD in-place as indicated in the Bid Form.
5. Payment: Payment will be made at the contract unit price bid per CUBIC YARD.

39 GCL

1. Description: This item covers providing and placement of a GCL as shown on the DRAWINGS if waste is encountered within utility trenches, irrigation trenches, or other excavations.
2. Work Required: Work required under this section includes but is not limited to the following:
   a. Providing and installing GCL liner as shown on the Drawings.
   b. The Contractor shall notify the Engineer and Architect if waste is encountered in trenches;

c. The Contractor shall document the locations of all waste encountered in excavations; and,
d. All labor, tools, equipment, materials, and incidentals necessary to complete the work as specified.

3. Unit of Measurement: SQUARE YARD
4. Measurement: Measurement for GCL will be per SQUARE YARD in-place as indicated in the Bid Form and as shown on the plans.
5. Payment: Payment will be made at the contract unit price bid per SQUARE YARD.

40 EXPLORATORY EXCAVATION

1. Description: Exploratory excavation will be used as a convenience to the Owner and/or Engineer or Architect when a subsurface condition needs to be verified.
2. Work Required: Work required under this section includes but is not limited to the following.
   a. Furnishing a fueled backhoe with an experienced operator and a laborer with shovel to excavate and backfill as directed; and
   b. All labor, tools, equipment, materials, royalties, and incidentals necessary to complete the work as specified.
3. Unit of Measurement: Hour
4. Measurement: Measurement for EXPLORATORY EXCAVATION will be made by the hour, rounded to the nearest one-half hour, for exploratory excavation authorized by the Engineer. The time will start when excavation begins and end when backfill has been completed. Time will be deducted for mechanical breakdowns.
5. Payment: Payment for EXPLORATORY EXCAVATION will be made at the contract unit price bid as a lump sum. If the Contractor elects to provide a smaller backhoe than specified, the bid item will be reduced in direct proportion that the rated capacity of the unit used to the unit specified. If the Contractor elects to provide a larger backhoe than specified, the bid item will be paid at the contract unit price bid per hour.

41 ELECTRICAL

1. Description: This item covers the installation of the electrical work as indicated.
2. Work Required: Work required under this section includes but is not limited to the following:
   a. Demolition of existing equipment.
   b. Installation of new service.
   c. Routing of new electrical systems.
   d. All labor, tools, equipment, materials, royalties, and incidentals necessary to complete the work as specified.
3. Unit of Measurement: LUMP SUM
4. Measurement: Measurement for ELECTRICAL will be made by LUMP SUM.
5. Payment: Payment will be made at the contract unit price bid per LUMP SUM.

42 SOFTBALL INFIELD CONSTRUCTION

1. Description: This item covers the construction of four softball infields as indicated.
2. Work Required: Work required under this section includes but is not limited to the following:

a. Subgrade preparation.
b. Loading, hauling, and placement of infield base material.
c. Installation of temporary edging.
d. Testing.
e. Screening, mixing of infield surfacing material, loading, hauling, and placement of infield surfacing material.
f. Finish grading of surfacing material.
g. Grade verifications.
h. All labor, tools, equipment, materials, royalties, and incidentals necessary to complete the work as specified.

3. Unit of Measurement: EACH
4. Measurement: Measurement for SOFTBALL INFIELD CONSTRUCTION will be per EACH as indicated in the Bid Form and as shown on the plans.
5. Payment: Payment will be made at the contract unit price bid per EACH.

43 SOFTBALL WARNING TRACK CONSTRUCTION

1. Description: This item covers the construction of three softball warning tracks as indicated.
2. Work Required: Work required under this section includes but is not limited to the following:
   a. Subgrade preparation.
   b. Installation of temporary edging.
   c. Testing
   d. Screening, mixing of infield/warning track surfacing material, loading, hauling, and placement of infield surfacing material.
   e. Finish grading of surfacing material.
   f. All labor, tools, equipment, materials, royalties, and incidentals necessary to complete the work as specified.
3. Unit of Measurement: EACH
4. Unit of Measurement: EACH
5. Measurement: Measurement for SOFTBALL WARNING TRACK CONSTRUCTION will be per EACH as indicated in the Bid Form and as shown on the plans.
6. Payment: Payment will be made at the contract unit price bid per EACH.

44 CHAIN LINK FENCING

1. Description: This item covers the installation of fencing and gates in sizes and types indicated.
2. Work Required: Work required under this section includes but is not limited to the following:
   a. Installation of fencing and gates along with any appurtenances.
   b. All labor, tools, equipment, materials, royalties, and incidentals necessary to complete the work as specified.
3. Unit of Measurement: LINEAL FOOT
4. Measurement: Measurement for CHAIN LINK FENCING will be per LINEAL FOOT as indicated in the Bid Form and as shown on the plans.
5. Payment: Payment will be made at the contract unit price bid per LINEAL FOOT.

45 DRILL SEEDED TURF

1. Description: This item covers the sowing of turf seed mix as indicated.
2. Work Required: Work required under this section includes but is not limited to the following:

a. Fine grading.
b. Seedbed preparation.
c. Sowing seed.
d. Protection and maintenance of seeded areas.
e. All labor, tools, equipment, materials, and incidentals necessary to complete the work as specified.

3. Unit of Measurement: SQUARE FOOT
4. Measurement: Measurement for DRILL SEEDED TURF will be per SQUARE FOOT as indicated in the Bid Form and as shown on the plans.
5. Payment: Payment will be made at the contract unit price bid per SQUARE FOOT.

46 SOD

1. Description: This item covers the installation of sod at drainage ditches in irrigated turf areas.
2. Work Required: Work required under this section includes but is not limited to the following:
   a. Fine grading.
   b. Seedbed preparation.
   c. Installation of sod at. Five feet wide from centerline on each side of ditch.
   d. Protection and maintenance of planted areas.
   e. All labor, tools, equipment, materials, royalties, and incidentals necessary to complete the work as specified.
3. Unit of Measurement: SQUARE FOOT
4. Measurement: Measurement for SOD will be per SQUARE FOOT as indicated in the Bid Form and as shown on the plans.
5. Payment: Payment will be made at the contract unit price bid per SQUARE FOOT.

47 DRYLAND SEEDING

1. Description: This item covers the sowing of dryland seed mix used as site restoration and seeding non-irrigated areas.
2. Work Required: Work required under this section includes but is not limited to the following:
   a. Fine grading.
   b. Seedbed preparation.
   c. Sowing seed.
   d. Hydromulch application.
   e. Protection and maintenance of seeded areas.
   f. All labor, tools, equipment, materials, royalties, and incidentals necessary to complete the work as specified.
3. Unit of Measurement: SQUARE FOOT
4. Measurement: Measurement for DRYLAND SEEDING will be per SQUARE FOOT as indicated in the Bid Form and as shown on the plans.
5. Payment: Payment will be made at the contract unit price bid per SQUARE FOOT.

48 DRYLAND SEEDING AT STEEP SLOPES

1. Description: This item covers the sowing of dryland seed mix used as site restoration and seeding non-irrigated areas on slopes of 3:1 or greater as indicated on the plans.

2. Work Required: Work required under this section includes but is not limited to the following:
    a. Finish grading.
    b. Sowing seed.
    c. Hydromulch application with increased mulch and tackifier.
    d. Protection and maintenance of seeded areas.
    e. All labor, tools, equipment, materials, royalties, and incidentals necessary to complete the work as specified.
3. Unit of Measurement: SQUARE FOOT
4. Measurement: Measurement for DRYLAND SEEDING AT STEEP SLOPES will be per SQUARE FOOT as indicated in the Bid Form and as shown on the plans.
5. Payment: Payment will be made at the contract unit price bid per SQUARE FOOT.

49 LANDSCAPE EDGING

1. Description: This item covers the installation of landscape edging as indicated on the plans.
2. Work Required: Work required under this section includes but is not limited to the following:
    a. All necessary prep work.
    b. Installation of edging.
    c. All labor, tools, equipment, materials, royalties, and incidentals necessary to complete the work as specified.
3. Unit of Measurement: LINEAL FOOT
4. Measurement: Measurement for LANDSCAPE EDGING will be per LINEAL FOOT as indicated in the Bid Form and as shown on the plans.
5. Payment: Payment will be made at the contract unit price bid per LINEAL FOOT.

50 PREPARATION FOR TREE PLANTING AT PARKING LOT ISLANDS (DOUBLE STALLS)

1. Description: This item covers the preparation and installation of materials at the individual parking lot islands prior placing topsoil. Islands are equal to two individual parking stalls in size. Importing and placement of topsoil is not included in this item.
2. Work Required: Work required under this section includes but is not limited to the following:
    a. All necessary prep work.
    b. Installation of GCL liner.
    c. Installation of root barrier.
    d. Installation of composite drain and bedding sand.
    e. Installation of weed barrier fabric and mulch.
    f. All labor, tools, equipment, materials, royalties, and incidentals necessary to complete the work as specified.
3. Unit of Measurement: EACH
4. Measurement: Measurement for PREPARATION FOR TREE PLANTING AT PARKING LOT ISLANDS (DOUBLE STALLS) will be per EACH as indicated in the Bid Form and as shown on the plans.
5. Payment: Payment will be made at the contract unit price bid per EACH.

51 PREPARATION FOR TREE PLANTING AT PARKING LOT ISLANDS (SINGLE STALLS)

1. Description: This item covers the preparation and installation of materials at the individual parking lot islands prior placing topsoil. Islands are equal to a single parking stall in size. Importing and placement of topsoil is not included in this item.
2. Work Required: Work required under this section includes but is not limited to the following:
    a. All necessary prep work.
    b. Installation of GCL liner.
    c. Installation of root barrier.
    d. Installation of composite drain and bedding sand.
    e. Installation of weed barrier fabric and mulch.
    f. All labor, tools, equipment, materials, royalties, and incidentals necessary to complete the work as specified.
3. Unit of Measurement: EACH
4. Measurement: Measurement for PREPARATION FOR TREE PLANTING AT PARKING LOT ISLANDS (SINGLE STALLS) will be per EACH as indicated in the Bid Form and as shown on the plans.
5. Payment: Payment will be made at the contract unit price bid per EACH.

52 ROCK MULCH INFILL

1. Description: This item covers the application of pre-emergent herbicide and installation of rock mulch as indicated.
2. Work Required: Work required under this section includes but is not limited to the following:
    a. All necessary prep work.
    b. Finish grading of surface material.
    c. Application of pre-emergent herbicide.
    d. Installation of mulch.
    e. All labor, tools, equipment, materials, royalties, and incidentals necessary to complete the work as specified.
3. Unit of Measurement: SQUARE FOOT
4. Measurement: Measurement for ROCK MULCH INFILL will be per SQUARE FOOT as indicated in the Bid Form and as shown on the plans.
5. Payment: Payment will be made at the contract unit price bid per SQUARE FOOT.

53 ORNAMENTAL TREE PLANTING

1. Description: This item covers the planting of 1-1/2" caliper deciduous ornamental trees as indicated.
2. Work Required: Work required under this section includes but is not limited to the following:
    a. All necessary prep work.
    b. Amendments, fertilizer, staking, and ring.
    c. Installation of tree per details.
    d. All labor, tools, equipment, materials, royalties, and incidentals necessary to complete the work as specified.
3. Unit of Measurement: EACH
4. Measurement: Measurement for ORNAMENTAL TREE PLANTING will be per EACH as indicated in the Bid Form and as shown on the plans.
5. Payment: Payment will be made at the contract unit price bid per EACH.

54 SHADE TREE PLANTING

1. Description: This item covers the planting of 2-1/2" caliper deciduous shade trees as indicated.
2. Work Required: Work required under this section includes but is not limited to the following:
    a. All necessary prep work.
    b. Amendments, fertilizer, staking, and ring.
    c. Installation of tree per details.
    d. All labor, tools, equipment, materials, royalties, and incidentals necessary to complete the work as specified.
3. Unit of Measurement: EACH
4. Measurement: Measurement for SHADE TREE will be per EACH as indicated in the Bid Form and as shown on the plans.
5. Payment: Payment will be made at the contract unit price bid per EACH.

55 EVERGREEN TREE PLANTING

1. Description: This item covers the planting of 5 – 6' tall evergreen trees as indicated.
2. Work Required: Work required under this section includes but is not limited to the following:
    a. All necessary prep work.
    b. Amendments, fertilizer, staking, and ring.
    c. Installation of tree per details.
    d. All labor, tools, equipment, materials, royalties, and incidentals necessary to complete the work as specified.
3. Unit of Measurement: EACH
4. Measurement: Measurement for EVERGREEN TREE will be per EACH as indicated in the Bid Form and as shown on the plans.
5. Payment: Payment will be made at the contract unit price bid per EACH.

56 IRRIGATION SYSTEM

1. Description: This item covers the installation of the irrigation system as indicated.
2. Work Required: Work required under this section includes but is not limited to the following:
    a. Modifications to existing mainline.
    b. Connection to the supply line stub-out outside of the meter pit.
    c. Installation of the backflow device and enclosure.
    d. Installation of all pipe, valves, sensors, heads, controls, and equipment.
    e. Control system programming.
    f. All labor, tools, equipment, materials, royalties, and incidentals necessary to complete the work as specified.
3. Unit of Measurement: LUMP SUM
4. Measurement: Not applicable.
5. Payment: Payment will be made at the contract unit price bid per LUMP SUM.

A1 WATER AND SANITARY SERVICES

1. Description: HDPE water and sanitary service lines in sizes and classes indicated on the drawings and in the contract documents. Service line installation shall be by: 1) Removing pavement and/or gravel, trench excavation, line installation, trench backfill, and pavement and/or gravel

restoration; or 2) Pushing or pulling the service line (method to be approved by Engineer) without destruction to surfacing; or 3) Combination of 1 and 2 or other method approved by the Engineer.

2. Work Required: Work required under this section shall include but not be limited to the following:
   a. Traffic control;
   b. Excavation and backfill;
   c. Dewatering, sheeting, and shoring required for installation;
   d. Furnishing and installing bedding;
   e. Testing, cleaning and disinfecting;
   f. Pushing or pulling service lines if applicable;
   g. Furnishing and installing HDPE service line;
   h. Furnishing and installing caps on unused lines;
   i. Surface restoration (pavement and/or gravel)
   j. All labor, tools, equipment, materials, royalties, and incidentals necessary to complete the work as specified.
3. Unit of Measurement: Per LINEAL FOOT.
4. Measurement: Measurement for WATER AND SANITORY SERVICES will be measured per LINEAL FOOT along the centerline of the pipe through all valves, fittings, and appurtenances as indicated in the Bid Form.
5. Payment: Payment will be made at the contract price bid per LINEAL FOOT for the various sizes and classes of WATER AND SANITORY SERVICES as indicated in the Bid Form and shall include the cost of trench excavation, pipe bedding, backfill and surface restoration.

A2 SOFTBALL INFIELD DRAINAGE

1. Description: This item covers the construction of the softball infield drainage as indicated.
2. Work Required: Work required under this section includes but is not limited to the following:
   a. Subgrade preparation.
   b. Trenching and backfill.
   c. Installation of sand.
   d. Installation of composite drain material, transport pipe, fittings, etc.
   e. Core drill tap into existing manhole and grout.
   f. All labor, tools, equipment, materials, royalties, and incidentals necessary to complete the work as specified.
3. Unit of Measurement: LUMP SUM
4. Measurement: Measurement for SOFTBALL INFIELD DRAINAGE will be made by LUMP SUM.
5. Payment: Payment will be made at the contract unit price bid per LUMP SUM.

A3 FERTILIZER

1. Description: This item covers the application of fertilizer at all irrigated turf areas prior to seeding.
2. Work Required: Work required under this section includes but is not limited to the following:
   a. Spreading of fertilizer.
   b. All labor, tools, equipment, materials, royalties, and incidentals necessary to complete the work as specified.

3. Unit of Measurement: LUMP SUM
4. Measurement: Measurement for FERTILIZER will be made by LUMP SUM.
5. Payment: Payment will be made at the contract unit price bid per LUMP SUM.

A4 SPLIT RAIL FENCING

1. Description: This item covers the installation of fencing in sizes and types indicated.
2. Work Required: Work required under this section includes but is not limited to the following:
    a. Installation of fencing along with any appurtenances.
    b. All labor, tools, equipment, materials, royalties, and incidentals necessary to complete the work as specified.
3. Unit of Measurement: LINEAL FOOT
4. Measurement: Measurement for SPLIT RAIL FENCING will be per LINEAL FOOT as indicated in the Bid Form and as shown on the plans.
5. Payment: Payment will be made at the contract unit price bid per LINEAL FOOT.

A5 PARRALLEL DG TRAIL SURFACING

1. Description: Contractor shall place owner provided decomposed granite surfacing next to asphalt trials as shown on the DRAWINGS.
2. Work required under this section shall include but not be limited to the following:
    a. Construction of all required handicap accessible ramps;
    b. Fine grading and preparation of base;
    c. Loading, hauling and installing owner provided decomposed granite surface;
    d. Furnishing and installing asphalt pavement;
    e. All labor, tools, equipment, materials, royalties and incidentals required to complete the work as specified.
3. Unit of Measurement: LINEAL FOOT
4. Measurement: Measurement for PARRALLEL DG TRAIL SURFACING will be per LINEAL FOOT as indicated in the Bid Form and as shown on the plans.
5. Payment: Payment for PARRALLEL DG TRAIL SURFACING will be made at the contract unit price bid per LINEAL FOOT as indicated in the Bid Form.

A6 ELECTRICAL CONDUIT

1. Description: This item covers the installation of the electrical conduit and ground mount boxes as indicated.
2. Work Required: Work required under this section includes but is not limited to the following:
    a. Trenching as required.
    b. Installation of conduit and ground mount boxes.
    c. All labor, tools, equipment, materials, royalties, and incidentals necessary to complete the work as specified.
3. Unit of Measurement: LUMP SUM
4. Measurement: Measurement for ELECTRICAL CONDUIT will be made by LUMP SUM.
5. Payment: Payment will be made at the contract unit price bid per LUMP SUM.

A7 ELECTRICAL SERVICE

1. Description: This item covers the installation of the electrical work as indicated.
2. Work Required: Work required under this section includes but is not limited to the following:
    a. Installation of new service.
    b. Routing of new electrical systems.
    c. All labor, tools, equipment, materials, royalties, and incidentals necessary to complete the work as specified.
3. Unit of Measurement: LUMP SUM
4. Measurement: Measurement for ELECTRICAL SERVICE will be made by LUMP SUM.
5. Payment: Payment will be made at the contract unit price bid per LUMP SUM.

A8 ELECTRICAL CONDUIT FOR LIGHTING

1. Description: This item covers the installation of the electrical conduit as indicated.
2. Work Required: Work required under this section includes but is not limited to the following:
    a. Trenching as required.
    b. Installation of conduit.
    c. All labor, tools, equipment, materials, royalties, and incidentals necessary to complete the work as specified.
3. Unit of Measurement: LUMP SUM
4. Measurement: Measurement for ELECTRICAL CONDUIT FOR LIGHTING will be made by LUMP SUM.
5. Payment: Payment will be made at the contract unit price bid per LUMP SUM.

A9 ELECTRICAL CONDUIT FOR LIGHTING

1. Description: This item covers the installation of the electrical conduit as indicated.
2. Work Required: Work required under this section includes but is not limited to the following:
    a. Trenching as required.
    b. Installation of conduit.
    c. All labor, tools, equipment, materials, royalties, and incidentals necessary to complete the work as specified.
3. Unit of Measurement: LUMP SUM
4. Measurement: Measurement for ELECTRICAL CONDUIT FOR LIGHTING will be made by LUMP SUM.
5. Payment: Payment will be made at the contract unit price bid per LUMP SUM.

A10 LIGHTING

1. Description: This item covers the installation of lighting and electrical service as indicated.
2. Work Required: Work required under this section includes but is not limited to the following:
    a. Trenching as required.
    b. Installation of lighting equipment and electrical service.

c. All labor, tools, equipment, materials, royalties, and incidentals necessary to complete the work as specified.

3. Unit of Measurement: LUMP SUM
4. Measurement: Measurement for LIGHTING will be made by LUMP SUM.
5. Payment: Payment will be made at the contract unit price bid per LUMP SUM.

A11 LIGHTING

1. Description: This item covers the installation of lighting and electrical service as indicated.
2. Work Required: Work required under this section includes but is not limited to the following:
   a. Trenching as required.
   b. Installation of lighting equipment and electrical service.
   c. All labor, tools, equipment, materials, royalties, and incidentals necessary to complete the work as specified.
3. Unit of Measurement: LUMP SUM
4. Measurement: Measurement for LIGHTING will be made by LUMP SUM.
5. Payment: Payment will be made at the contract unit price bid per LUMP SUM.

END OF SECTION 01275

SECTION 01340 - SUBMITTALS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division 1 Specification sections, apply to work of this section.

1.2 DESCRIPTION OF REQUIREMENTS:

A. The types of submittal requirements specified in this section include shop drawings, product data, samples and miscellaneous work-related submittals. Individual submittal requirements are specified in applicable sections for each unit of work. Refer to other Division-l sections and other contract documents for requirements of administrative submittals.

B. Definitions: Work-related submittals of this section are categorized for convenience as follows:

1. Shop drawings include specially-prepared technical data for this project, including drawings, diagrams, performance curves, data sheets, schedules, templates, patterns, reports, calculations, instructions, measurements and similar information not in standard printed form for general application to a range of similar projects.

2. Product data include standard printed information on materials, products and systems; not specially-prepared for this project, other than the designation of selections from among available choices printed therein.

3. Samples include both fabricated and unfabricated physical examples of materials, products and units of work; both as complete units and as smaller portions of units of work; either for limited visual inspection or (where indicated) for more detailed testing and analysis.

C. Miscellaneous submittals related directly to the work (non- administrative) include warranties, maintenance agreements, workmanship bonds, project photographs, survey data and reports, physical work records, quality testing and certifying reports, copies of industry standards, record drawings, field measurement data, operating and maintenance materials, overrun stock, and similar information, devices and materials applicable to the work and not processed as shop drawings, product data or samples.

1.3 GENERAL SUBMITTAL REQUIREMENTS:

A. Coordination and Sequencing: Coordinate preparation and processing of submittals with performance of the work so that work will not be delayed by submittals. Coordinate and sequence different categories of submittals for same work so that one will not be delayed for coordination of A/E's review with another.

B. Preparation of Submittals: Provide permanent marking on each submittal to identify project, date, Contractor, subcontractor, submittal information. Show Contractor's executed review and approval marking and provide space for Architect's/Engineer's "Action" marking.

1.4 SPECIFIC-CATEGORY SUBMITTAL REQUIREMENTS:

A. Shop Drawings: Provide newly-prepared information, on reproducible sheets with graphic information at accurate scale. Show dimensions and note which are based on field measurement. Identify materials and products in the work shown. Indicate compliance with standards, and special coordination requirements. Do not allow shop drawing copies without appropriate final "Action" markings by Architect/Engineer to be used in connection with the work.

1. Initial Submittal: One correctable translucent reproducible print and one blue-line or black-line print: reproducible will be returned.

2. Final Submittal: 6 prints, plus 2 additional prints where required for maintenance manuals; 2 will be retained and remainder will be returned, one of which is to be marked-up and maintained by Contractor as "Record Document".

B. Product Data: Collect required data into one submittal for each unit of work or system; and mark each copy to show which choices and options are applicable to project. Include manufacturer's standard printed recommendations for application and use, compliance with standards, application of labels and seals, notation of field measurements which have been checked, and special coordination requirements.

1. Submittals: Do not submit product data, or allow its use on the project, until compliance with requirements of contract documents has been confirmed by Contractor. Submittal is for information and record, unless otherwise indicated. Initial submittal is final submittal unless returned promptly by Architect/Engineer, marked with an "Action" which indicates an observed noncompliance. Submit 6 copies, plus 2 additional copies (which will be returned) where required for maintenance manuals.

2. Installer's Copy: Do not proceed with installation of materials, products or systems until final copy of applicable product data is in possession of Installer.

C. Samples: Provide units identical with final condition of proposed materials or products for the work. Include "range" samples (not less than 3 units) where unavoidable variations must be expected. Samples are submitted for review and confirmation of color, pattern, texture and "kind" by Architect/ Engineer. Architect/Engineer will not "test" samples (except as otherwise indicated) for compliance with other requirements, which are therefore the exclusive responsibility of Contractor.

D. Inspection and Test Reports: Classify each as either "shop drawing" or "product data". depending upon whether report is uniquely prepared for project or a standard publication of workmanship control testing at point of production, and process accordingly.

E. Warranties: Refer to "Products" section for specific general requirements on warranties, product/workmanship bonds, and maintenance agreements.

F. Closeout Submittals: Refer to individual work sections and to "closeout" sections for specific requirements on submittal of closeout information, materials, tools and similar items.

1. Record Document Copies: Furnish one set.

2. Maintenance/Operating Manuals: Furnish 4 bound copies.

3. Materials and Tools: Refer to individual work sections for required quantities of spare parts, extra and overrun stock, maintenance tools and devices, keys, and similar physical units to be submitted.

G. General Distribution: Provide additional distribution of submittals (not included in foregoing copy submittal requirements) to subcontractors, suppliers, fabricators, installers, and others as necessary for proper performance of the work. Include such additional copies in transmittal to Architect/Engineer where required to receive "Action" marking before final distribution. Record distributions on transmittal forms.

1.5 ACTION ON SUBMITTALS:

A. Architect's/Engineer's Action: Where action and return is required or requested, Architect/Engineer will review each submittal, mark with "Action", and where possible, return within two weeks of receipt. Where submittal must be held for coordination, Contractor will be so advised by A/E without delay.

B. Action Stamp: Architect's/Engineer's action stamp, for use on submittals to be returned to Contractor, is self-explanatory as marked.

END OF SECTION 01340

SECTION 01505 - TEMPORARY FACILITIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division 1 Specification sections, apply to work of this section.

1.2 DESCRIPTION OF REQUIREMENTS:

Specific administrative and procedural minimum actions are specified in this section, as extensions of provisions in General Conditions and other contract documents. These requirements have been included for special purposes as indicated. Nothing in this section is intended to limit types and amounts of temporary work required, and no omission from this section will be recognized as an indication by Architect or Engineer that such temporary activity is not required for successful completion of the work and compliance with requirements of contract documents. Provisions of this section are applicable to, but not by way of limitation, utility services, construction facilities, security/protection provisions, and miscellaneous facilities.

1.3 QUALITY ASSURANCE:

A. Comply with governing regulations and rules/ recommendations of franchised utility companies, local ordinances, regulations.

B. Standards: Comply with the requirements of NFPA Code 241, "Building Construction and Demolition Operations", the ANSI-AlO Series standards for "Safety Requirements for Construction and Demolition" and the NECA National Joint Guideline NJG-6 "Temporary Job Utilities and Services".

1.4 JOB CONDITIONS:

A. Establish and initiate use of each temporary facility at time first reasonably required for proper performance of the work. Terminate use and remove facilities at earliest reasonable time, when no longer needed or when permanent facilities have, with authorized use, replaced the need.

B. Conditions of Use: Install, operate, maintain and protect temporary facilities in a manner and at locations which will be safe, non-hazardous, sanitary and protective of persons and property, and free of deleterious effects.

PARTS 2 and 3 - PRODUCTS AND EXECUTION

2.1 TEMPORARY UTILITY SERVICES:

A. Arrange for local service companies to extend utilities indicated to the project site. Comply with service companies' recommendations on materials and methods, or engage service companies to install services. Locate services to minimize interference with construction operations. Types of temporary services include, but not by way of limitation, the following:

1. Telephone Service in temporary construction office.

2. Water Service and Distribution.

3. Temporary Heating Fuel.

4. Electrical Power.

B. Metering: Provide meters for water and electrical power services. Read meters and record readings weekly, and include in progress report to Architect/Engineer at monthly intervals. Cost of temporary services paid by Contractor.

2.2 TEMPORARY CONSTRUCTION FACILITIES:

A. The types of temporary construction facilities required may include, but not by way of limitation, water distribution, drainage, dewatering equipment, enclosure of work, heat, ventilation, electrical power distribution, lighting, hoisting facilities, stairs, ladders, and roads. Provide facilities reasonably required to perform construction operations properly and adequately and in compliance with governing regulations.

B. Temporary Water: Provide water service and distribution piping of sizes and pressures adequate for construction purposes until permanent service is completed. Provide hose lengths sufficient to reach entire area of construction work, not less than 3/4" hose size. Prevent freezing of water distribution by either prompt drainage after each use, or by suitable protection. Maintain 30 psi minimum water pressure at hose outlets. Protect water source from contamination, provide vacuum breaker.

C. Temporary Enclosure: Provide temporary enclosure to ensure adequate workmanship and protection from weather and unsatisfactory ambient conditions for the work, including enclosure where temporary heat is used. Provide lumber and plywood. Provide tarpaulins with UL label and flame spread of 15 or less; provide translucent type (nylon reinforced polyethylene) where daylighting of enclosed space would be beneficial for workmanship, and reduce use of temporary lighting.

At all times provide protection against weather which includes, but not by way of limitation, rain, snow, wind, storms, frost and heat so as to maintain all work, materials, apparatus and fixtures free from injury or damage. Provide all pumps, pipes, equipment and enclosures to secure this protection. At the end of day's work, all new work likely to be damaged shall be covered or otherwise protected.

D. Temporary Heat: Provide temporary heat to protect, dry all work during cold and/or wet weather, to maintain temperatures, conditions indicated by other specification sections for each type of work to be performed.

1. Prior to enclosure provide, maintain self-contained heaters bearing UL or FM approved labels and known to be safe and without deleterious effect on work in place. Vent heaters and equip all units with individual space thermostatic controls. Open fuel oil salamanders, coal, coke or wood burning heaters will not be permitted.

E. Temporary Mechanical Ventilation: Where natural ventilation of work in progress is not sufficient for proper workmanship, either with or without temporary heating, provide power ventilators in conjunction with openings in temporary (or permanent) enclosure

work. Provide and operate either exhaust or supply fans/blowers, or both, sufficient to ventilate work adequately.

F. Temporary Electrical Power: Provide weatherproof, grounded, power distribution system sufficient to accommodate construction operations requiring power, use of power tools, lighting, and start-up testing of permanent electric-powered equipment prior to its permanent connection to electrical system. Comply with National Electrical Code (NFPA 70).

G. Temporary Lighting: Provide sufficient temporary lighting to ensure proper workmanship everywhere; by combined use of daylight, general lighting, and portable plug-in task lighting. Provide general lighting with local switching which will enable energy conservation during periods of varying activity (work-in-progress, traffic only, security check, lock-up, etc.). Provide additional lighting on an "as-needed" basis for satisfactory performance of the work.

H. Temporary Access Provisions: Provide ramps, stairs, ladders and similar temporary access elements as reasonably required to perform the work and facilitate its inspection during installation. When permanent stairs are available for access during construction, cover finished surfaces with sufficient protection to ensure freedom from damage and deterioration at time of substantial completion.

2.3 SECURITY/PROTECTION PROVISIONS:

A. The types of temporary security and protection provisions required include, but not by way of limitation, fire protection, barricades, warning signs/lights, enclosure/lockup, environmental protection, weather protection and similar provisions intended to minimize property losses, personal injuries and claims for damages at project site. Provide security/protection services and systems in coordination with activities and in a manner to achieve 24-hour, 7-day-per-week effectiveness.

B. Fire Extinguishers: Provide types, sizes, numbers and locations to comply with local ordinances or recommendations of NFPA No. 10.

C. Barricades, Warning Signs and Lights:

General: Comply with recognized standards and code requirements for the erection of substantial, structurally adequate barricades where needed to prevent injury and losses. Paint with appropriate colors, graphics and warning signs to inform personnel at the site and the public, of the hazard being protected against. Provide lighting where appropriate and needed, including flashing red lights where appropriate.

D. Enclosure and Lockup: At earliest possible date, secure against unauthorized entrance at times when personnel are not working. Provide secure temporary enclosures at locations of possible entry, with locked entrances.

E. Environmental Protection Procedures: Provide facilities, establish procedures, and conduct construction activities in a manner which will ensure compliance with regulations controlling construction activities. Enforce strict discipline on activities related to generation of wastes, pollution of air/water/soil, generation of noise, and similar effects which might violate regulations or reasonably irritate persons at or in vicinity of project site.

Provide dust suppression controls during all earthwork.

2.4 TEMPORARY MISCELLANEOUS FACILITIES:

A. The types of miscellaneous temporary facilities required may include, but not by way of limitation, field offices, storage sheds, sanitary facilities, first aid facilities, thermometer, project identification signs, and similar miscellaneous general services, all as may be reasonably required for proficient performance of the work and accommodation of personnel at the site including Owner's and Architect's/ Engineer's personnel. Discontinue and remove temporary support facilities, and make incidental similar use of permanent work of the project, only when and in manner authorized by Architect/ Engineer.

B. Temporary Field Office: Provide adequate office space for field office personnel plus one spare work station for incidental use by subcontractor's, Architect/Engineer's personnel. Provide walls with tack-board material for posting of notices, progress schedule and similar information; shelf space adequate for storage of specifications, shop drawings, manufacturer's data, samples.

C. Temporary Sheds: The Contractor shall provide temporary shed or mobile storage unit for storage, fabrication and similar purposes. Sheds: located where indicated or other suitable arrangements made.

D. Temporary Sanitary Facilities: Beginning at time of start of work, provide and maintain self-contained toilet units of type acceptable to governing authorities, adequate for use by personnel at project site. Provide facilities for male and female personnel when both sexes are working at project site.

E. First Aid Facilities: Provide appropriate first aid kits on site, furnish personnel trained in first aid procedures.

F. Thermometer: Provide accurate thermometer graduated in degrees Fahrenheit; mount on temporary office.

G. Drinking Water: Provide dispenser-type drinking water units with potable water. Furnish paper cups and waste receptacles.

END OF SECTION 01505

SECTION 01605 - PRODUCTS AND SUBSTITUTIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division 1 Specification sections, apply to work of this section.

1.2 DESCRIPTION OF REQUIREMENTS:

A. Definitions:

"Products" is defined to include purchased items for incorporation into the work, regardless of whether specifically purchased for project or taken from Contractor's stock of previously purchased products.

"Materials," is defined as products which must be substantially cut, shaped, worked, mixed, finished, refined or otherwise fabricated, processed, installed or applied to form units of work.

"Equipment" is defined as products with operational parts, regardless of whether motorized or manually operated, and particularly including products with service connections (wiring, piping, etc.).

Definitions in this paragraph are not intended to negate the meaning of other terms used in contract documents, including "specialties", "systems", "structure", "finishes", "accessories", "furnishings", "special construction", and similar terms, which are self-explanatory and have recognized meanings in the construction industry.

B. Substitutions: The requirements for substitutions do not apply to specified Contractor options on products and construction methods. Revisions to contract documents, where requested by Owner, Architect or Engineer, are "changes" not "substitutions."

Requested substitutions during bidding period, which have been accepted prior to Contract Date, are included in contract document and are not subject to requirements for substitutions as specified herein. Contractor's determination of and compliance with governing regulations and orders issued by governing authorities do not constitute "substitutions" and do not constitute a basis for change orders, except as provided for in contract documents.

Otherwise, Contractor's requests for changes in products, materials and methods of construction required by contract documents are considered requests for "substitutions", and are subject to requirements hereof.

C. Standards: Refer to Division 1 section, "Definitions and Standards", for applicability of industry standards to products of project, and for acronyms used in text of specification sections.

1.3 QUALITY ASSURANCE:

A. Source Limitations: To the greatest extent possible, for each unit of work provide products, materials or equipment of a singular generic kind and from a single source.

B. Compatibility of Options: Where more than one choice is available as options for Contractor's selection of a product or material, select an option which is compatible with other products and materials already selected. Total compatibility among options is not assured by limitations within contract documents, but must be provided by Contractor. Compatibility is a basic general requirement of product/material selections.

1.4 SUBMITTALS:

Requests for Substitutions: Submit 3 copies, fully identified for product or method being replaced by substitution, including related specification section and drawing number(s), and fully documented to show compliance with requirements for substitutions. Include product data/drawings, description of methods, samples where applicable, Contractor's detailed comparison of significant qualities between specified item and proposed substitution, statement of effect on construction time and coordination with other affected work, cost information or proposal, and Contractor's statement to the effect that proposed substitution will result in overall work equal to or better than work originally indicated.

1.5 PRODUCT DELIVERY, STORAGE, HANDLING:

General: Deliver, handle and store products in accordance with manufacturer's recommendations and by methods and means which will prevent damage, deterioration, and loss including theft. Control delivery schedules to minimize long-term storage of products at site and over-crowding of construction spaces. In particular, provide delivery/installation coordination to ensure minimum holding or storage times for products recognized to be flammable, hazardous, easily damaged, or sensitive to deterioration, theft and other sources of loss.

1.6 WARRANTIES (GUARANTEES):

A. Categories of Specific Warranties: Warranties on the work are in several categories, including those of General Conditions, and including (but not necessarily limited to) the following specific categories related to individual units of work specified in sections of Divisions 2 through 16 of these specifications:

1. Special Project Warranty (Guarantee): A warranty specifically written and signed by Contractor for a defined portion of the work and, where required, countersigned by subcontractor, installer, manufacturer or other entity engaged by Contractor.

2. Specified Product Warranty: A warranty which is required by contract documents, to be provided for a manufactured product incorporated into the work, regardless of whether manufacturer has published a similar warranty without regard for specific incorporation of product into the work, or has written and executed a special project warranty as a direct result of contract document requirements.

3. Coincidental Product Warranty: A warranty which is not specifically required by contract documents (other than as specified in this Section) but which is available on a product incorporated into the work by virtue of the fact that manufacturer of product has published warranty in connection with purchases

and uses of product without regard for specific applications except as otherwise limited by terms of warranty.

B. Refer to individual sections of Divisions 2 through 16 for the determination of units of work which are required to be specifically or individually warranted, and for the specific requirements and terms of those warranties (or guarantees).

C. For product warranties not specifically described in Divisions 2 through 16, the Contractor shall and does hereby warrant and/or guarantee the following:

For a period of one year from date of substantial completion all moveable or adjustable work shall remain in perfect working order, including hardware, doors, windows, drawers, apparatus, machinery, electrical equipment, valves, appliances, controls, devices, and all equipment to which this heading is applicable.

D. General Limitations: It is recognized that specific warranties are intended primarily to protect Owner against failure of the work to perform as required, and against deficient, defective and faulty materials and workmanship, regardless of sources. Except as otherwise indicated, specific warranties do not cover failures in the work which result from: 1) unusual and abnormal phenomena of the elements; 2) the Owner's misuse, maltreatment or improper maintenance of the work; 3) vandalism after time of substantial completion: or 4) insurrection or acts of aggression including war.

E. Related Damages and Losses: In connection with Contractor's correction of warranted work which has failed, remove and replace other work of project which has been damaged as a result of such failure, or must be removed and replaced to provide access for correction of warranted work.

1. The Contractor shall respond within seven (7) calendar days after notice of observed defects has been given and he shall proceed to immediately remedy these defects.

2. Should the Contractor fail to respond to the notice or not remedy those defects, the Owner will have this work corrected at the expense of the Contractor.

F. Reinstatement of Warranty Period: Except as otherwise indicated, when work covered by a special project warranty or product warranty has failed and has been corrected by replacement or restoration, reinstate warranty by written endorsement, starting on date of acceptance of replaced or restored work, for a period of time ending upon date original warranty would have expired if there had been no failure.

G. Replacement Cost, Obligations: Except as otherwise indicated, costs of replacing or restoring failing warranted units or Products is Contractor's obligation, without regard for whether Owner has already benefited from use through a portion of anticipated useful service lives.

H. Contractor's Procurement Obligations: Do not purchase, subcontract for, or allow others to purchase or sub-subcontract for materials or units of work for project where a special project warranty, specified product warranty, certification or similar commitment is required, until it has been determined that entities required to countersign such commitments are willing to do so.

PART 2 - PRODUCTS

2.1 GENERAL PRODUCT COMPLIANCES:

A. General: The compliance requirements, for individual products as indicated in contract documents, are multiple in nature and may include generic, descriptive, proprietary, performance, prescriptive, compliance with standards, compliance with codes, conformance with graphic details and other similar forms and methods of indicating requirements, all of which must be complied with. No extension of time or substitution of material will be allowed because of ill-timed procurement procedures.

B. Material and Product Selection: It is the Contractor's responsibility to ascertain that all materials and products selected by him or for him by his subcontractors and material suppliers, conform with requirements of the Contract Documents. Proposals shall be based only upon materials, products and equipment as specified or approved by written addendum issued by Architect prior to receipt of proposal. No substitution will be considered due to failure to comply with this requirement. Contractor's options for selecting products are limited by contract document requirements, and governing regulations, and are not controlled by industry traditions or procedures experienced by Contractor on previous construction projects. Required procedures include, but are not necessarily limited to, the following for various indicated methods of specifying:

1. Single Product/Manufacturer Name: Provide product indicated, except advise Architect/Engineer before proceeding, where known that named product is not a feasible or acceptable selection.

2. Two or More Product/Manufacturer Names: Provide one of the named products, at Contractor's option; but excluding products which do not comply with requirements. Do not provide or offer to provide an unnamed product, except where none of named products comply with requirements or are a feasible selection; advise Architect/Engineer before proceeding.

3. "Or Approved": Where named products in specifications text are accompanied by the term "or approved" or other language of similar effect, comply with those contract document provisions concerning "substitutions" for obtaining Architect's/Engineer's approval to provide an unnamed product.

4. "Named", except as otherwise indicated, is defined to mean manufacturer's name for product, as recorded in published product literature, of latest issue as of date of contract documents. Refer requests to use products of a later (or earlier) model to Architect/Engineer for acceptance before proceeding.

5. Standards, Codes and Regulations: Where only compliance with an imposed standard, code or regulation is required, selection from among products which comply with requirements including those standards, codes and regulations, is Contractor's option.

6. Performance Requirements: Provide products which comply with specific performances indicated, and which are recommended by manufacturer (in published product literature or by individual certification) for application indicated. Overall performance of a product is implied where product is specified with only certain specific performance requirements.

7. Visual Matching: Where matching with an established sample is required, final judgment of whether a product proposed by Contractor matches sample satisfactorily is Architect's judgment. Where no product within specified cost category is available which matches sample satisfactorily and complies with requirements, comply with contract document provisions concerning "substitutions" and "change orders" for selection of a matching product outside established cost category or of a product not complying with requirements.

8. Visual Selection: Except as otherwise indicated, where specified product requirements include "...as selected from manufacturer's standard colors, patterns, textures..." or words of similar effect, the selection of manufacturer and basic product (complying with requirements) is Contractor's option, and subsequent selection of color, pattern and texture is Architect's selection. Where specified product requirements include "...as selected from standard colors, patterns, textures available within the industry...". or words to that effect. selection of product (complying with requirements, and within established cost category) is Architect's selection, including designation of manufacturer where necessary to obtain desired color, pattern or texture.

2.2 SUBSTITUTIONS:

A. Conditions: Contractor's request for substitution will be received and considered when extensive revisions to contract documents are not required and changes are in keeping with general intent of contract documents; when timely, fully documented and properly submitted; and when one or more of following conditions is satisfied, all as judged by Architect/ Engineer. Otherwise, requests will be returned without action except to record non-compliance with these requirements.

1. Where request is directly related to an "or equal" clause or other language of same effect in contract documents.

2. Where required product, material or method cannot be provided within Contract Time, but not as a result of Contractor's failure to pursue the work promptly or to coordinate various activities properly.

3. Where required product, material or method cannot be provided in a manner which is compatible with other materials of the work, or cannot be properly coordinated therewith, or cannot be warranted as required, or cannot be used without adversely affecting Owner's insurance coverage on completed work, or will encounter other substantial non-compliances which are not possible to otherwise overcome except by making requested substitution, which Contractor thereby certifies to overcome such non-compatibility, non-coordination, non-warranty, non-insurability or other non-compliance as claimed.

4. Where required product, material or method cannot receive required approval by a governing authority, and requested substitution can be so approved.

B. By making requests for substitutions, the Contractor:

1. represents that he has personally investigated the proposed product and determined that it is equal or superior in all respects to that specified;

2. represents that he will provide the same warranty for the substitution that he would for that specified;

3. certifies that the cost data presented is complete and includes all related costs under this Contract and includes all related costs under separate contracts but excludes the Architect's redesign costs, and waives all claims for additional costs related to the substitution which subsequently become apparent; and

4. will coordinate the installation of the accepted substitute, making such changes as may be required for the Work to be complete in all respects.

C. Work-Related Submittals: Contractor's submittal of, and Architect's/Engineer's acceptance of, shop drawings, product data or samples which relate to work not complying with requirements of contract documents does not constitute an acceptable and valid request for a substitution nor approval thereof.

2.3 GENERAL PRODUCT REQUIREMENTS:

A. General: Provide products which comply with requirements, and which are undamaged and unused at time of installation, and which are complete with accessories, trim, finish, safety guards and other devices and details needed for a complete installation and for intended use and effect.

1. Standard Products: Where available, provide standard products of types which have been produced and used previously and successfully on other projects and in similar applications.

2. Continued Availability: Where additional amounts of a product, by nature of its application, are likely to be needed by Owner at a later date for maintenance and repair or replacement work, provide a standard, domestically produced product which is likely to be available to Owner at such later date.

B. Nameplates: Except as otherwise indicated for required approval labels and operating data, do not permanently attach or imprint manufacturer's or producer's nameplates or trademarks on exposed surfaces of products which will be exposed to view either in occupied spaces or on exterior of the work.

1. Labels: Locate required labels and stamps on a concealed surface or, where required for observation after installation, on an accessible surface which, in occupied spaces, is not conspicuous.

2. Equipment Nameplates: Provide permanent nameplate on each item of service-connected or power operated equipment. Indicate manufacturer, product name, model number, serial number, capacity, speed, ratings and similar essential operating data. Locate nameplates on an easily accessed surface which, in occupied spaces, is not conspicuous.

END OF SECTION 01605

SECTION 01705 - PROJECT CLOSEOUT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division 1 Specification sections, apply to work of this section.

1.2 DESCRIPTION OF REQUIREMENTS:

Definitions: "Closeout" is hereby defined to include general requirements near end of Contract Time in preparation for final acceptance, final payment, normal termination of contract, occupancy by Owner and similar actions evidencing completion of the work. Specific requirements for individual units of work are specified in sections of Divisions 2 through 16. Time of closeout is directly related to "Substantial Completion", and therefore may be either a single time period for entire work or a series of time periods for individual parts of the work which have been certified as substantially complete at different dates. That time variation (if any) shall be applicable to other provisions of this section.

1.3 PREREQUISITES TO SUBSTANTIAL COMPLETION:

A. General: Prior to requesting Architect's/Engineer's inspection for certification of substantial completion (for either entire work or portions thereof), complete the following and list known exceptions in request:

1. In progress payment request, coincident with or first following date claimed, show either 100% completion for portion of work claimed as "substantially complete", or list incomplete items, value of incompletion, and reasons for being incomplete.

2. Advise Owner of pending insurance change-over requirements.

3. Submit specific warranties, workmanship/maintenance bonds, maintenance agreements, final certifications and similar documents.

4. Obtain and submit releases enabling Owner's full and unrestricted use of the work and access to services and utilities, including (where required) occupancy permits, operating certificates, and similar releases.

5. Deliver tools, spare parts, extra stocks of materials, and similar physical items to Owner.

6. Make final change-over of locks and transmit keys to Owner, and advise Owner's personnel of change-over in security provisions.

7. Complete start-up testing of systems, and instructions of Owner's operating/maintenance personnel. Discontinue (or change over) and remove from project site temporary facilities and services, along with construction tools and facilities, mock ups, and similar elements.

8. Complete final cleaning up requirements, including touch-up painting of marred surfaces.

B. Inspection Procedures: Upon receipt of Contractor's request, Architect/Engineer will either proceed with inspection or advise Contractor of prerequisites not fulfilled. Following initial inspection, Architect/Engineer will either prepare certificate of substantial completion, or advise Contractor of work which must be performed prior to issuance of certificate; and repeat inspection when requested and assured that work has been substantially completed. Results of completed inspection will form initial "punch-list" for final acceptance.

1.4 PREREQUISITES TO FINAL ACCEPTANCE:

A. General: Prior to requesting Architect's/Engineer's final inspection for certification of final acceptance and final payment, as required by General Conditions, complete the following and list known exceptions (if any) in request:

1. Submit final payment request with final releases and supporting documentation not previously submitted and accepted. Include certificates of insurance for products and completed operations where required.

2. Submit final meter readings for utilities, and similar data as of time of substantial completion or when Owner took possession of and responsibility for corresponding elements of the work.

3. Submit consent of surety.

4. Submit Affidavit on Behalf of Contractor.

B. Reinspection Procedure: Upon receipt of Contractor's notice that the work has been completed, including punch-list items resulting from earlier inspections, and excepting incomplete items delayed because of acceptable circumstances, Architect/Engineer will reinspect the work. Upon completion of reinspection, Architect/Engineer will either prepare certificate of final acceptance or advise Contractor of work not completed or obligations not fulfilled as required for final acceptance.

1.5 RECORD DOCUMENT SUBMITTALS:

A. Record Drawings: Maintain a white-print set (blue-line or black-line) of contract drawings and shop drawings in clean, undamaged condition, with mark-up of actual installations which vary substantially from the work as originally shown. Mark whichever drawing is most capable of showing "field" condition fully and accurately: however, where shop drawings are used for mark-up, record a cross-reference at corresponding location on working drawings. Mark with red erasable pencil and, where feasible, use other colors to distinguish between variations in separate categories of work. Mark up new information which is recognized to be of importance to Owner, but was for some reason not shown on either contract drawings or shop drawings. Give particular attention to concealed work, which would be difficult to measure and record at a later date. Note related change order numbers where applicable. Organize record drawing sheets into manageable sets, bind with durable paper cover sheets, and print suitable titles, dates and other identification on cover of each set.

B. Maintenance Manuals: Organize maintenance-and-operating manual information into suitable sets of manageable size, and bind into individual binders properly identified and indexed (thumb- tabbed). Include emergency instructions, spare parts listing, copies of warranties, wiring diagrams, recommended "turn-around" cycles, inspection procedures, shop drawings, product data, and similar applicable information. Bind each manual of each set in a heavy- duty 2", 3-ring vinyl-covered binder, and include pocket folders for folded sheet information. Mark identification on both front and spine of each binder.

The manual shall describe the material installed and shall be in sufficient detail to permit operating personnel to understand, operate and maintain all equipment. Each complete, bound manual shall include the following information in addition to requirements noted above.

1. Index sheet stating Contractor's address and telephone number, duration of guarantee period, list of equipment with names and addresses of local manufacturer representatives.
2. Product Data: One copy of each Product Data submittal required by Contract Documents.
3. Complete operating and maintenance instructions on all major equipment.
4. Written instruction as required by individual specification sections.
5. Complete parts lists and tables for all major equipment installed.
6. Certifications required by Contract Documents.
7. Copies of warranties required by Contract Documents.
8. Print outs showing initial programming settings.
9. Any other information required by individual specification sections.

Instruct the Owner's designated personnel in the operation and programming of all systems. Show written evidence to the Owner's Representative at the conclusion of the project that this service has been rendered.

PART 2 - PRODUCTS (not applicable)

PART 3 - EXECUTION

3.1 CLOSEOUT PROCEDURES:

General Operating/Maintenance Instructions: Arrange for each installer of work requiring continuing maintenance or operation, to meet with Owner's personnel, at project site, to provide basic instructions needed for proper operation and maintenance of entire work. Include instructions by manufacturer's representatives where installers are not expert in the required procedures. Review maintenance manuals, record documentation, tools, spare parts and materials, lubricants, fuels, identification system, control sequences, hazards, cleaning and similar procedures and facilities. For operational equipment, demonstrate start-up, shut-down, emergency operations, noise and vibration adjustments, safety, economy/efficiency adjustments, energy effectiveness. and similar operations. Review maintenance and operations in relation with applicable warranties, agreements to maintain, bonds, and similar continuing commitments.

3.2 FINAL CLEANING:

A. General: Special cleaning for specific units of work is specified in sections of Divisions 2 through 16. General cleaning during progress of work is specified in General Conditions and as temporary services in "Temporary Facilities" section of this Division. Provide final cleaning of the work, at time indicated, consisting of cleaning each surface or unit of work to normal "clean" condition expected for a first-class building cleaning and maintenance program. Comply with manufacturer's instructions for cleaning operations. The following are examples, but not by way of limitation, of cleaning levels required:

1. Remove labels which are not required as permanent labels.

2. Clean transparent materials, including mirrors and window/door glass, to a polished condition, removing substances which are noticeable as vision-obscuring materials. Replace broken glass and damaged transparent materials.

3. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of dust, stains, films and similar noticeable distracting substances. Except as otherwise indicated, avoid disturbance of natural weathering of exterior surfaces. Restore reflective surfaces to original reflective condition.

4. Wipe surfaces of mechanical and electrical equipment clean, remove excess lubrication and other substances. Clean fans, coils, and replace dirty filters.

5. Remove debris and surface dust from limited-access spaces including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics and similar spaces.

6. Clean concrete floors in non-occupied spaces broom clean.

7. Clean plumbing fixtures free of stains, including those resulting from water exposure.

8. Clean light fixtures and lamps so as to function with full efficiency.

9. Clean project site (yard and grounds), including landscape development areas, of litter and foreign substances.

B. Removal of Protection: Except as otherwise indicated or requested by Architect/Engineer, remove temporary protection devices and facilities which were installed during course of the work to protect previously completed work during remainder of construction period.

C. Compliances: Comply with safety standards and governing regulations for cleaning operations. Do not burn waste materials at site, or bury debris or excess materials on Owner's property, or discharge volatile or other harmful or dangerous materials into drainage systems; remove waste materials from site and dispose of in a lawful manner.

END OF SECTION 01705

SECTION 02225 - IRRIGATION TRENCHING AND BACKFILL

PART 1 - GENERAL

1.1 DESCRIPTION:

Work in this section consists of all labor, materials, and equipment necessary to do all work and related items as shown on the drawings, specified herein or incidental to proper execution of the work, including trenching, boring under driveways, walks, and curbs, installation of pipe sleeves, and backfilling.

1.2 RELATED WORK DESCRIBED ELSEWHERE:

Irrigation System - Section 02760

1.3 QUALITY ASSURANCE:

For actual prosecution of the work, use only personnel who are skilled in the work required, familiar with recommended methods of installation, and thoroughly familiar with the requirements of this work.

1.4 UNDERGROUND OBSTRUCTIONS:

The Contractor shall contact all utilities for locations of their installations prior to initiating work.

The Contractor shall preserve, intact, any underground pipes or other utilities encountered during construction. In case any such utilities or other structures are accidentally broken or damaged, they shall be immediately replaced in a condition at least equal to that in which they were found, all at the expense of the Contractor.

PART 2 - MATERIALS

2.1 PIPE SLEEVES:

Pipe sleeves shall be Schedule 40 PVC pipe, 4" diameter, or equal approved by the Owner's Representative.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS:

A. Inspection

Prior to all work of this section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.

Verify that trenching may be completed in accordance with the original design and the referenced standards.

B. Discrepancies

In the event of discrepancy, immediately notify the Owner's Representative.

Do not proceed with installation in areas of discrepancy until all discrepancies have been fully resolved.

Beginning of installation means acceptance of existing conditions by installer.

3.2 TRENCHING:

A. General

Perform all trenching required for the installation of items where the trenching is not specifically described in other sections of these Specifications.

Make all trenches in accordance with OSHA Requirements with sufficient width to provide free working space at both sides of the trench and around the installed item as required for gluing, joining, backfilling, and compacting while minimizing width of trenches.

B. Depth

Trench as required to provide the elevations shown on the Plans.

Trench to sufficient depth to give a minimum of 18 inches of fill above the top of the pipe measured from the adjacent finished grade under driveways and sidewalks.

All mainline shall have a minimum cover of 18" above the pipe. All laterals shall have a minimum cover of 12" above the pipe.

C. Correction of Faulty Grades

Where trench excavation is inadvertently carried below proper elevations, backfill with material approved by the Owner's Representative and then compact to provide a firm and unyielding subgrade to the approval of the Owner's Representative and at no additional cost to the Owner.

D. Trench Bracing

Properly support all trenches in strict accordance with all pertinent rules and regulations.

Brace, sheet, and support trench walls in such a manner that they will be safe and that the ground alongside the excavation will not slide or settle, and that all existing improvements of every kind will be fully protected from damage.

In the event of damage to such improvements, immediately make all repairs and replacements necessary to the approval of the Owner's Representative and at no additional cost to the Owner.

Arrange all bracing, sheeting and shoring so as to not place stress on any portion of the completed work until the general construction thereof has proceeded far enough to provide sufficient strength.

E. Removal of Trench Bracing

Exercise care in the drawing and removal of sheeting, shoring, bracing, and timbering to prevent collapse or caving of the excavation faces being supported.

F. Grading and Stockpiling Trenched Material

Control the stockpiling of trenched material in a manner to prevent water running into the excavations.

Do not obstruct surface drainage but provide means whereby storm and waste waters are diverted into existing gutters, other surface drains, or temporary drains.

G. Methods

All trench excavation shall be made by open cut. During excavation, material suitable for backfilling shall be piled in an orderly manner a sufficient distance from the banks of the trench to avoid overloading, and to prevent slides or cave-ins. All material not required for backfill or not suitable for backfill, shall be removed from the site by the Contractor.

Landfill waste is not suitable backfill material and shall be disposed of as specified.

Banks of trenches shall be kept as nearly vertical as possible, and shall be properly sheeted and braced as may be necessary to prevent caving.

Trench widths in paved streets or in areas where proximity to other structures require vertical cuts, shall not be wider than is required for proper handling, jointing and bedding of the pipe.

The bottom of the trenches shall be accurately graded to line and grade, and provide uniform bearing and support for each section of the pipe on undisturbed soil, at every point along its entire length. Depressions for joints shall be dug after the trench bottom has been graded, and shall be only of such length, depth and width as required for properly making the particular type joint. Care shall be taken not to excavate below the depths indicated.

Where rock occurs in trench excavation, the rock shall be removed to a depth of six (6) inches below the established grade line, and to a width of twelve (12) inches greater than the outside diameter of the pipe to be installed in the trench.

H. Pavement Removal

Where excavation of trenches requires the removal of asphaltic pavement, the pavement shall be cut in a straight line along the edge of the excavation by use of a spade-bitted air hammer, concrete saw or similar approved equipment to obtain straight, square and clean break; and, after backfilling and subgrade preparations are completed, hot plant mix asphaltic concrete shall be replaced and compacted.

Excess material, including rock, broken concrete, bituminous materials, debris or other materials not suitable for backfill, shall be removed from the site and disposed of by the Contractor.

3.3 BORING:

A. Locations

Boring shall be used to route pipe, wiring, or both under concrete structures such as walks or curbs where trenching is impractical. Sleeves shall be installed in all bored holes.

B. Method

Boring shall be accomplished with a drill, auger, water jet, or any other instrument approved by the Owner's Representative capable of producing a precise hole. Boring shall not disturb overlaying structures or cause settlement and damage to those structures.

3.4 SLEEVES:

A. Locations

Sleeves shall be installed wherever routing of a pipe, wiring, or both crosses a paved area or passes through a bored hole.

B. Methods

Sleeves laid in open trenches shall be uniformly and evenly supported by undisturbed soil on the trench bottom. Backfill shall conform to standards hereinafter specified.

Sleeves installed in borings shall be forced through and shall have a snug fit throughout the length of the bored hole. Sleeves cracked or broken shall not be accepted.

3.5 BACKFILL:

A. Inspection

The trenching shall not be backfilled until inspection has been completed and the pipe installation, including the grade, alignment and jointing has been found to be in compliance with the requirements of the plans and specifications.

B. Around and Over Pipe

Select backfill material consisting of sand, fine gravel or select earth, free of large lumps or rocks larger than 3/4 inch shall be used in backfilling around and over the installed pipe.

The select material shall be obtained from the excavation material removed from the trench and shall be processed by screening, sifting, or selective sorting, so as to produce the type of backfill herein specified. The Contractor may at his option and own expense provide an acceptable imported material.

This backfill material shall be carefully deposited around and over the pipe in layers not more than six (6) inches thick, loose measurement, unless otherwise permitted by the Owner's Representative, wetted to optimum moisture content and uniformly compacted to at least 95 percent of the maximum density obtainable at optimum moisture content

as determined by AASHTO T99 Method A or D (latest revision), until the pipe has a cover depth of at least one (1) foot.

C. Remainder of Trench Backfill

The remaining depth of the trench shall be backfilled with excavation material removed from the trench, which shall be wetted or dried to near optimum moisture content.

Inclusion of a limited amount of stones and rocks will be permitted. Stones and rocks shall in no case be larger than two inches diameter, and they shall be placed so that each piece is completely surrounded with material compacted to the density hereinafter specified. The size and amount of rocks used in backfill shall be such that they will not interfere with proper compaction.

This material shall be carefully deposited in layers of a thickness suitable to the equipment selected by the Contractor for proper compaction and compacted to at least 95 percent of the maximum density as determined by AASHTO T99 Method A or D (latest revisions). The method of compaction selected by the Contractor shall not cause damage of any nature to the installed pipe.

The use of a water puddling of this portion of the trench backfilling may be used if the specified density can be obtained and the backfill material is suitable for this type of trench compaction.

3.6 PAVEMENT REPLACEMENT:

Pavement replacement shall utilize the same materials and design as the original pavement.

3.7 CLEANUP:

Upon completion of the work, the entire site shall be cleared of all debris, and ground surfaces shall be finished to smooth, uniform slopes and shall present a neat and workmanlike appearance. Cleanup shall be considered an incidental item, and no additional payment shall be made for any cleanup item. All fences, culverts, gravel driveways or other obstructions removed during construction, shall be replaced in a condition at least equal to their existing condition.

3.8 MAINTENANCE:

The Contractor shall, for a period of one (1) year after completion and final acceptance of the work, maintain and repair any trench or boring settlement which may occur, and shall make suitable repairs to any pavements, sidewalks, or other structures which may become damaged as a result of settlement. All such maintenance and repair shall be at the Contractor's expense.

END OF SECTION 02225

SECTION 02232-SITE CLEARING

PART 1-GENERAL

1.1 RELATED DOCUMENTS

Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
1. Protecting existing trees and vegetation to remain.
2. Removing trees and other vegetation.
3. Clearing and grubbing.
4. Topsoil stripping.
5. Removing above-grade site improvements.
6. Disconnecting, capping or sealing, and abandoning site utilities in place.
7. Disconnecting, capping or sealing, and removing site utilities.

B. Related Sections include the following:
1. Division 1 Section "Construction and Temporary Facilities" for temporary utilities, temporary construction and support facilities, temporary security and protection facilities, and environmental protection measures during site operations.
2. Division 2 Section "Earthwork" for soil materials, excavating, backfilling, and site grading.
3. Division 2 Section "Seeding" for finish grading, including placing and preparing topsoil for lawns and planting.

1.3 DEFINITIONS

Topsoil: Natural or cultivated surface-soil layer containing organic matter and sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 2 inches (50 mm) in diameter; and free of weeds, roots, and other deleterious materials.

1.4 MATERIALS OWNERSHIP

Except for materials indicated to be stockpiled or to remain Owner's property, cleared materials shall become Contractor's property and shall be removed from the site.

1.5 SUBMITTALS

A. Photographs or videotape, sufficiently detailed, of existing conditions of trees and plantings, adjoining construction, and site improvements that might be misconstrued as damage caused by site clearing.

B. Record drawings according to Division 1 Section "Closeout Procedures."
1. Identify and accurately locate capped utilities and other subsurface structural, electrical, and mechanical conditions.

1.6 PROJECT CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.
   1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
   2. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.

B. Improvements on Adjoining Property: Work on adjoining properties is not included in the scope of this project.

C. Salvageable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises where indicated.

D. Notify utility locator service for area where Project is located before site clearing.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. Satisfactory Soil Materials: Requirements for satisfactory soil materials are specified in Division 2 Section "Earth Work."
   1. Obtain approved borrow soil materials off-site when satisfactory soil materials are not available on-site.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect and maintain benchmarks and survey control points from disturbance during construction.

B. Provide erosion-control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

C. Locate and clearly flag trees and vegetation to remain or to be relocated.

D. Protect existing site improvements to remain from damage during construction.
   1. Restore damaged improvements to their original condition, as acceptable to Owner.

3.2 TREE PROTECTION

A. Erect and maintain a temporary fence around drip line of individual trees or around perimeter drip line of groups of trees to remain. Remove fence when construction is complete.
   1. Do not store construction materials, debris, or excavated material within drip line of remaining trees.
   2. Do not permit vehicles, equipment, or foot traffic within drip line of remaining trees.

B. Do not excavate within drip line of trees, unless otherwise indicated.

C. Where excavation for new construction is required within drip line of trees, hand clear and excavate to minimize damage to root systems. Use narrow-tine spading forks, comb soil to expose roots, and cleanly cut roots as close to excavation as possible.
   1. Cover exposed roots with burlap and water regularly.
   2. Temporarily support and protect roots from damage until they are permanently relocated and covered with soil.
   3. Coat cut faces of roots more than 1-1/2 inches (38 mm) in diameter with an emulsified asphalt or other approved coating formulated for use on damaged plant tissues.
   4. Cover exposed roots with wet burlap to prevent roots from drying out. Backfill with soil as soon as possible.

D. Repair or replace trees and vegetation indicated to remain that are damaged by construction operations, in a manner approved by Engineer.
   1. Employ a qualified arborist, licensed in jurisdiction where Project is located, to submit details of proposed repairs and to repair damage to trees and shrubs.
   2. Replace trees that cannot be repaired and restored to full-growth status, as determined by the qualified arborist.

E. Transplant trees and vegetation indicated to be relocated to the location designated by the Engineer, in a manner approved by Engineer.
   1. Employ a qualified arborist or landscaping expert, licensed in jurisdiction where Project is located, to transplant trees and shrubs.
   2. Operation shall be completed in such manner as to protect the root wad of the tree or other vegetation.

3.3 UTILITIES

A. Owner will arrange for disconnecting and sealing indicated utilities that serve existing structures before site clearing when requested by Contractor.
   1. Verify that utilities have been disconnected and capped before proceeding with site clearing.

B. Locate, identify, disconnect, and seal or cap off utilities indicated to be removed.
   1. Owner will arrange to shut off indicated utilities when requested by Contractor.
   2. Arrange to shut off indicated utilities with utility companies.

C. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
   1. Notify Engineer not less than two weeks in advance of proposed utility interruptions.
   2. Do not proceed with utility interruptions without Engineer's written permission.

D. Excavate for and remove underground utilities indicated to be removed.

3.4 CLEARING AND GRUBBING

A. Remove obstructions, trees, shrubs, grass, and other vegetation to permit installation of new construction. Removal includes digging out stumps and obstructions and grubbing roots.
   1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
   2. Cut minor roots and branches of trees indicated to remain in a clean and careful manner where such roots and branches obstruct installation of new construction.

3. Completely remove stumps, roots, obstructions, and debris extending to a depth of 18 inches (450 mm) below exposed subgrade.
4. Use only hand methods for grubbing within drip line of remaining trees.

B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material, unless further excavation or earthwork is indicated.
1. Place fill material in horizontal layers not exceeding 8-inch (200-mm) loose depth, and compact each layer to a density equal to adjacent original ground.

3.5 TOPSOIL STRIPPING

A. Remove sod and grass before stripping topsoil.

B. Strip topsoil to whatever depths are encountered in a manner to prevent intermingling with underlying subsoil or other waste materials.
1. Strip surface soil of unsuitable topsoil, including trash, debris, weeds, roots, and other waste materials.

C. Stockpile topsoil materials away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water.
1. Do not stockpile topsoil within drip line of remaining trees.
2. Dispose of excess topsoil as specified for waste material disposal.
3. Stockpile surplus topsoil and allow for respreading deeper topsoil.

3.6 SITE IMPROVEMENTS

A. Remove existing above- and below-grade improvements as indicated and as necessary to facilitate new construction.

B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.
1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut length of existing pavement to remain before removing existing pavement. Saw-cut faces vertically.

3.7 DISPOSAL

A. Disposal: Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials, including trash and debris, and legally dispose of them off Owner's property.

END OF SECTION 02232

SECTION 02275A-GEOSYNTHETIC CLAY LINER (GCL)

PART 1 - GENERAL

This section sets forth the requirements for the geosynthetic clay liner.

1.1 WORK INCLUDED

Geosynthetic clay liner shall be furnished and installed as shown on the drawings and as required herein for proper installation and functioning of the liner system for the purpose of solid waste containment.

1.2 REFERENCES

A. The following test methods shall be incorporated into this specification in their entirety, subject to the indicated test modifications:

1. ASTM D 4632, "Standard Test Method for Grab Breaking Load and Elongation of Geotextiles"
2. ASTM D 4643, "Determination of Water (Moisture) Content of Soil by the Microwave Oven Method"
3. ASTM D 5084, "Standard Test Method for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter"
4. ASTM D 5261, "Standard Test Method for Measuring Mass Per Unit Area of Geotextiles"
5. ASTM D 5321, "Determining the Coefficient of Soil and Geosynthetic or Geosynthetic and Geosynthetic Friction by the Direct Shear Method"
6. ASTM D 5887, "Measurement of Index Flux Through Saturated Geosynthetic Clay Liner Specimens Using a Flexible Wall Permeameter"
7. ASTM D 5888, "Standard Guide for Storage and Handling of Geosynthetic Clay Liners"
8. ASTM D 5889, "Standard Practice for Quality Control of Geosynthetic Clay Liners"
9. ASTM D 5890, "Standard Test Method for Swell Index of Clay Mineral Component of Geosynthetic Clay Liners"
10. ASTM D 5891, "Standard Test Method for Fluid Loss of Clay Component of Geosynthetic Clay Liners"

B. Qualifications - The GCL Manufacturer and Installer shall all be skilled in accordance with the following experience requirements. Any exceptions must be approved by the project engineer prior to the project bid.

C. GCL Manufacturer - The GCL manufacturer selected for use on this project shall have successfully produced at least 10,000,000 square feet of needle punched GCL product.

D. GCL Installer - The installer shall provide to the engineer sufficient evidence of installation experience and competence with the specified geosynthetic materials.

1.3 SUBMITTALS

A. Four copies of the project submittals shall be forwarded to the project engineer as designated below:

1. Prior to Installation - The following information shall be supplied to the project engineer for review within 10 business days of the Contract Award to ensure that the materials and parties selected for use on the project meet the requirements of this specification.
   a. Statement of experience from the proposed GCL supplier.
   b. Statement of experience from the proposed GCL installer.
   c. Samples of GCL proposed for use on the project.
   d. Reference list supplied by GCL manufacturer indicating the appropriate experience level as required by the specification.
   e. Reference list supplied by the GCL installer indicating the appropriate experience level as required by the specification.
2. Prior to Deployment - The following information shall be submitted by the Contractor to the Project Engineer prior to the deployment of any GCL material to ensure that the materials and subgrade preparation meet the requirements of this specification.
   a. GCL Manufacturer's Quality Control Certifications.
   b. Results of Conformance Testing specified within Section 3.5.
   c. Certifications of subgrade acceptance for each area covered by GCL signed by the Installer, General Contractor and Engineer.

PART 2 - MATERIALS

2.1 GENERAL

The geosynthetic clay liner (GCL) shall be a needle-punched, reinforced GCL. The GCL shall consist of a composite consisting of granular sodium bentonite encapsulated between a woven geotextile and non-woven geotextile. The composite GCL shall be reinforced with needle-punching to provide shear strength with fully hydrated bentonite. The needle punched GCL shall be thermally locked. The thermal lock process must heat set the non-woven fibers where they protrude from the woven geotextile to more permanently secure the reinforcement in place. The GCL shall be Bentofix NSL or equivalent.

2.2 BENTONITE

General: Geosynthetic clay liner shall be factory-manufactured for the purpose of providing a hydraulic barrier. Bentonite shall be high-swelling sodium bentonite, first quality product mined and processed specifically for the purpose of manufacturing a geosynthetic clay liner.

2.3 BENTONITE PROPERTIES

TABLE 1

Property	Test Method	Units	Value	Minimum Test Frequency
Swell Index (2 grams)	ASTM D 5890	ml	24 (minimum)	1/100,000 lbs

Moisture Content	ASTM D4643	%	<12	1/100,000 lbs
Fluid Loss	ASTM D 5891	ml	≤18	1/100,000 lbs
Bentonite Mass Per Unit Area [(1)]	ASTM D 5993	lb/ft^2	0.75 Marv	1/40,000 ft^2

(1) Oven dried to zero percent moisture.

Bentonite Certification and Testing: The bentonite supplier shall sample and test bentonite during processing to ensure product quality. The geosynthetic clay liner manufacturer shall sample and test bentonite for quality assurance. The Contractor shall submit certificates from the bentonite supplier and geosynthetic clay liner manufacturer to the Engineer for approval prior to deployment of geosynthetic clay liner at the site.

2.4 GEOSYNTHETIC CLAY LINER PROPERTIES

A. The geosynthetic clay liner shall meet or exceed the minimum average roll values for the physical and hydraulic properties on Table 2.

TABLE 2

Property	Test Method	Units	Value	Minimum Test Frequency
Non-woven Geotextile	ASTM D 5261	oz/yd^2	6.0 Marv	1/200,000 ft^2
Woven Geotextile	ASTM D5761	oz/yd^2	3.1 Marv	1/200,000 ft^2
Grab Strength	ASTM D4632	lbs	≥ 95 Marv	1/40,000 ft^2
Index Flux[1]	ASTM D5887	$m^3/m^2/sec$	$\leq 1x10^{-8}$	1/week
Peel Strength	ASTM D 4632	lbs	>15	1/40,000 ft^2
Internal Shear Strength	ASTM D 5821	lb/ft^2	>500	1/200,000 ft^2
Permeability	ASTM D 5084	cm/sec	$<5x10^{-9}$	1/100,000 ft^2

[1] De-aired tap water @ 5 psi maximum effective confining stress and 2 psi head.

B. A geotextile composite GCL shall be needle-punched to provide shear resistance when the bentonite is fully hydrated. The non-woven fibers shall be thermally locked. The GCL shall be Bentofix NSL or equivalent.

2.5 GEOSYNTHETIC CLAY LINER ROLLS

A. General: Geosynthetic clay liner shall be new, first quality and manufactured specifically for the purpose of this project. The geosynthetic clay liner shall have no holes, pinholes, bubbles, blisters, nicks, tears, cuts on edges, or contamination by foreign

matter. Geosynthetic clay liner shall be supplied in rolls. Folding shall not be permitted.

B. Manufacturer Certification: The Contractor shall submit written manufacturer certification to the Engineer for approval that the geosynthetic clay liner conforms to the material requirements of these Specifications; is similar to and of the same formulation as that for which certification is submitted; and has been demonstrated by actual usage to be satisfactory for the intended application. Manufacturer certification shall include the minimum average roll values for material to be furnished on this project. The Contractor shall obtain Engineer's approval of the geosynthetic clay liner prior to shipment to the site. The Contractor will not be allowed to unload or store on site any material that is delivered prior to obtaining such approval.

C. Dimensions: The minimum acceptable dimensions for the GCL panels shall be 15 feet wide and 125 feet long. Short rolls (rolls less than 125 feet long) may be supplied, but at a rate not to exceed 5% of the total square footage produced for this project.

D. Overlap Markings: A minimum overlap guide-line and a construction match-line delineating the overlap zone shall be imprinted with non-toxic ink on both edges of the GCL panel to ensure the accuracy of the seam. These lines shall be used during CQA to ensure the minimum overlap is achieved. The minimum overlap guideline shall indicate where the edge of the panel must be placed in order to achieve a full six inches of bentonite overlap for each panel.

PART 3 - MANUFACTURING QUALITY CONTROL

3.1 ROLL IDENTIFICATION

Each roll shall be labeled or tagged with roll identification number, name of manufacturer, date of production, product type and grade, lot number, physical dimensions, and roll weight. The label or tag information shall be fixed or attached to the roll at all times during deployment of the roll. The product identification number, manufacturer name and lot number shall also be stenciled onto the start of each roll so that a positive verification can be made with label or tag information.

3.2 QUALITY CONTROL

Geosynthetic clay liner shall be monitored throughout the manufacturing process for project integrity and consistency. Manufacturer shall sample rolls for the physical properties and at the minimum frequency as detailed within Table 1 and Table 2 of this specification or per lot whichever results in the greatest number of tests.

Certified test results shall be submitted to and approved by the Engineer at least ten (10) working days prior to geosynthetic clay liner deployment at the site. The Contractor shall submit a list which indicates date of production, plant location, lot number, manufacturing liner number and identification number and square footage of each geosynthetic clay liner roll. Rolls shall be listed in the order of production with the status of the roll (approved or rejected for shipment). All rolls shall be included in the list whether or not approved for shipment to the project.

3.3 MANUFACTURER QUALITY CONTROL CERTIFICATION

Quality Control certificates shall be issued by the GCL manufacturer to the project engineer or other designated party for each delivery of material. The certifications shall be signed by the quality control manager of the GCL manufacturer or other responsible party and shall include the following information:

1. Shipment Packing List - A list indicating the rolls shipped on a particular truckload.
2. Bill of Lading - The shipping documents for the truck used for the shipment.
3. Letter of Certification - The letter indicating the material is in conformance with the physical properties specified.
4. Physical Properties Sheet - The material specification for the GCL supplied in accordance with this specification.

3.4 MANUFACTURER QUALITY CONTROL SUBMITTAL

A. Quality Control submittals shall be issued by the GCL manufacturer to the project engineer or other designated party for each lot of material. The submittals shall include the following information:

1. Bentonite Manufacturer Certification - Bentonite manufacturer quality documentation for the particular lot of clay used in the production of the rolls delivered.
2. Geotextile Manufacturer Certification - Geotextile manufacturer quality control documentation for the particular lots of geotextiles used in the production of the rolls delivered.
3. GCL Manufacturer Tracking List - Cross referencing list delineating the corresponding geotextile and bentonite lots for the materials used in the production of the rolls delivered.
4. Manufacturing Quality Control Data - The manufacturing quality control test data indicating the actual test values obtained when tested at the appropriate frequencies for the properties specified in Table 1 and Table 2.

B. Packaging - All GCL rolls shall be packaged in moisture resistant plastic sleeves. The cardboard cores shall be sufficiently strong to resist collapse during transit and handling.

C. Accessory Bentonite - any accessory bentonite used for sealing seams, penetrations, or repairs, shall be the same granular bentonite as used in the production of the GCL itself.

3.5 CONFORMANCE TESTING

The Engineer will sample GCL materials which have arrived on-site for conformance testing. The Contractor will be responsible for forwarding conformance samples to a certified, third party, testing laboratory for testing. Conformance samples will be taken a minimum of each lot or every 100,000 square feet of material whichever results in more tests (Minimum of 2 samples). GCL samples will be tested for Swell Index, Moisture Content, Bentonite Mass Per Unit Area, Fluid Loss, Grab Strength, Index Flux, Internal Sheer Strength, and Peel Strength. Samples will be tested to insure conformance with the specifications listed within Table 1 and Table 2 of this section.

No GCL material shall be installed until conformance testing is complete on that material and results show that the delivered material meets the requirements of the specifications. Material which fails to meet the requirements of the conformance testing shall be rejected and not utilized within the project. Rejected material will be replaced

with material meeting the specifications at no additional cost to the Owner. The Contractor shall pay for all costs associated with this conformance testing and retesting of new material, if necessary.

PART 4 - SHIPPING STORAGE AND HANDLING

4.1 GENERAL

Geosynthetic clay liner shall be shipped, stored and handled in accordance with the manufacturer's recommendation and as specified herein. Contractor shall be completely responsible for shipping, storage and handling of all geosynthetic clay liner. The geosynthetic clay liner rolls shall be delivered to the site only after the Engineer receives and approves the required submittals.

4.2 SHIPPING

Contractor shall notify the Engineer at least twenty-four (24) hours prior to scheduled delivery. No materials shall be unloaded except in the presence of the Engineer or the Engineer's representative. Geosynthetic clay liner delivered to the site shall be inspected for damage and unloaded and stored with minimal handling.

Damaged rolls shall be separated from undamaged rolls until proper disposition of material is determined by the Engineer. The Engineer will be the final authority on the determination of damage.

4.3 HANDLING

No hooks, tongs or other sharp tools or instrument shall be used for handling geosynthetic clay liner. Contractor shall use manufacturer-approved methods for loading and unloading GCL rolls for deployment. The GCL must be supported during handling to prevent damage to the liner. Geosynthetic clay liner shall not be folded, dragged along the ground, lifted with only the forks of a lift truck, or pushed to the ground from the delivery vehicle.

4.4 STORAGE

Geosynthetic clay liner shall be protected from precipitation, moisture, soil, mud, dirt, debris, puncture, cutting or other damaging or deleterious conditions. The GCL shall be stored and stockpiled in accordance with the manufacturer's recommendations.

PART 5 - SUPPORTING SURFACE PREPARATION

5.1 SURFACES

Surfaces to be lined shall be smooth and free of all rocks, sharp stones, sticks, roots, sharp objects, or debris of any kind. The surface shall provide a firm unyielding foundation for geosynthetic clay liner with no sudden, sharp, or abrupt changes or breaks in grade. All rocks greater than 3 inches shall be removed from subgrade. No abrupt changes greater than one inch shall be allowed in the subgrade such as that caused by a vehicle rut. The surface shall also be free of standing water, snow or ice.

5.2 ACCEPTANCE OF SOIL SUBGRADE

The Engineer will conduct a walkthrough of the subgrade at which time the General Contractor and Installer shall both verify in writing that the soil subgrade is acceptable for installation of geosynthetics. The Contractor shall be responsible for maintenance of these areas to the accepted condition until completion of the project. If the subgrade is damaged during liner deployment it shall be repaired to the specification prior to liner installation. The subgrade shall meet the requirements of Technical Specification 02/230.

5.3 MAINTENANCE

The Contractor shall maintain the surface suitability and integrity of the soil subgrade until project is completed and accepted. Contractor shall repair rough areas, ruts and any other damage to the subgrade prior to geosynthetics deployment.

5.4 FINAL INSPECTION

No geosynthetic shall be installed until the supporting surface has been inspected and approved for geosynthetic installation by the Engineer and Contractor. The Contractor shall correct all deficiencies in the supporting surface that have appeared since the acceptance of soil subgrade at no additional cost to the Owner.

PART 6 - GEOSYNTHETIC CLAY LINER INSPECTION

6.1 Material Inspection: The Contractor shall visually inspect all geosynthetic clay liner for imperfections, faulty or suspect areas for possible damage prior to installation. All such defective liners shall be marked, repaired, and/or tested. Liners that cannot be repaired shall be removed from the work area and replaced at no additional cost to the Owner. Contractor shall replace faulty material that requires more than one patch per 5,000 square feet of geosynthetic clay liner at no additional cost to the Owner.

PART 7 - INSTALLATION

7.1 GENERAL

The number of panels deployed in one day shall be limited to the number of panels which can be installed, anchored, and protected from moisture on the same day.

7.2 PANEL LAYOUT

Contractor shall submit panel layout drawing to and obtain approval of the Engineer prior to commencement of any geosynthetic clay liner work.

7.3 PANEL IDENTIFICATION

Each panel shall be marked with an "identification code" (numeric or alphanumeric) consistent with the layout plan. The identification code shall be simple and logical and approved for use by the Engineer.

7.4 WEATHER CONDITIONS

A. The geosynthetic clay liner shall not be deployed during precipitation, in the presence of excessive moisture, in areas of ponded water, or in the presence of excessive winds. If the bentonite in the GCL becomes hydrated prior to coverage with the 60 mil HDPE liner, geotextile and base protective cover soil, the Engineer will require that this material be removed from the installation.

B. Wind Protection The Contractor shall protect the geosynthetic clay liner against adverse effects of high winds such as uplift. Sand bags may be used for this purpose. Sand bags shall be sufficiently close-knit to preclude fines from working the bottom, sides or seams. Sand bags that are split, torn or otherwise losing their contents shall be immediately removed from the work area and any spills immediately cleaned up.

7.5 GCL PLACEMENT

A. GCL Material shall be placed in accordance with the procedures specified below, or modified to account for site specific conditions.
1. GCL Orientation - GCL panels should be placed with the woven side up.
2. GCL Panel Position - Where possible, all slope panels should be installed parallel to the slope while panels installed in flat areas require no particular orientation.
3. Panel Deployment - GCL materials shall be installed in general accordance with the procedures set forth in this section.

B. Reinforced GCL shall be used on both slopes as well as the flat areas to ensure the GCL withstands the rigors of the installation.
1. Deployment should proceed from the highest elevation to the lowest to facilitate drainage in the event of precipitation.
2. The GCL may be deployed on slopes by pulling the material from a suspended roll, or securing a roll end into an anchor trench and unrolling each panel as the handling equipment slowly moves backwards.
3. Deployment on flat areas shall be conducted in the same manner as that for the slopes, however, care should be taken to minimize "dragging" the GCL. A slip-sheet may be used to facilitate positioning of the liner while ensuring the GCL is not damaged from underlying sources.
4. Overlaps shall be a minimum of 12 inches and be free of wrinkles, folds or "fishmouths".
5. The Contractor shall only install as much GCL that can be covered at the end of the day. No GCL shall be left exposed overnight. The exposed edge of the GCL shall be covered by a temporary tarpaulin or other such water resistant sheeting until the next working day.

C. Anchoring - All GCL material installed on slopes shall be anchored per the plans to prevent potential GCL panel movement. The GCL shall be placed into and across the base of the excavated trench, stopping at the back wall of the excavation.

D. Seaming -
1. Overlap seams shall be a minimum of 12 inches on panel edges and two feet on panel ends. Panel end overlaps shall not be located on slopes.
2. Loose granular bentonite should be placed between panels at a rate of ¼ pound per lineal foot of seam.

E. Detailing - Detail work, defined as the sealing of the liner to pipe penetrations, drainage structures, spillways, and other appurtenances shall be performed as recommended by the GCL manufacturer.

F. Damage Repair - Prior to cover material placement, damage to the GCL shall be identified and repaired by the installer. Damage is defined as any rips or tears in the geotextiles, delamination of geotextiles or a displaced panel.

1. Rip and Tear Repair (Flat Surfaces) - Rips or tears may be repaired by completely exposing the affected area, removing all foreign objects or soil, and by then placing a patch cut from unused GCL over the damage (damaged material may be left in place), with a minimum overlap of 12 inches on all edges. Accessory bentonite should be placed between the patch edges and the repaired material at a rate of a quarter pound per lineal foot of edge spread in a continuous six inch fillet.
2. Rip and Tear Repair (Slopes) - Damaged GCL material on slopes shall be repaired by the same procedures above, however, the edges of the patch should also be adhered to the repaired liner with a manufacturer-approved adhesive to keep the patch in position during backfill or cover operations.
3. Displaced Panels - Displaced panels shall be adjusted to the correct position and orientation. The adjusted panel shall then be inspected for any geotextile damage or bentonite loss. Damage shall be repaired by the above procedure.
4. Premature Hydration - If the GCL is subjected to premature hydration, the GCL shall be removed from the installation and replaced under the direction of the Engineer.

G. Contractor shall use equipment which does not damage geosynthetic clay liner or supporting subgrade surface.

H. No personnel shall be allowed to engage in activities that could damage geosynthetic clay liners.

I. Clamps and other metal tools used in the work area shall have rounded edges (no sharp) corners. Clamps and other metal tools shall not be tossed or thrown.

J. Panels shall be unrolled with a method that protects geosynthetic clay liner from scratches and crimps and protects the subgrade from damage.

K. Contractor shall place adequate temporary hold-downs to prevent uplift by wind. Hold-downs shall not damage geosynthetic clay liner and shall be continuous along edges to minimize risk of wind flow under panels.

L. Contractor shall protect geosynthetic clay liner in heavy traffic areas by geotextile, extra geosynthetic clay liner or other suitable materials. Materials used for protection shall be temporary and shall not be used as any part of the permanent installation. Contractor shall not allow vehicle traffic on geosynthetic clay liner surface.

M. Two layers of GCL are required under leachate trenches and the leachate sump as indicated on the plans. Each layer of GCL shall be installed per the specifications.

PART 8 - CONSTRUCTION QUALITY CONTROL

8.1 GENERAL

The Contractor shall designate a full time superintendent to be responsible for supervising construction of the GCL.

8.2 FINAL SEAM INSPECTION

For final seaming inspection, seams and surface of geosynthetic clay liner shall be checked for defects, holes, blisters, undispersed raw materials, or signs of contamination by foreign matter. The contractor shall distinctively mark, preferably with paint, repair areas, and indicate required type of repair.

8.3 DRAWINGS AND DATA

A. Complete specifications, data and detailed drawings covering the material furnished under this section shall be submitted for approval in accordance with the procedure set forth in the General Conditions. Data and specifications shall include, but shall not be limited to the following:

1. Bentonite:
   a. Bentonite Supplier Certification
2. Geosynthetic Clay Liner Rolls:
   a. Roll Manufacturer Certification.
   b. Roll Manufacturer Certification and specified MQC testing.
   c. Manufacturer's quality control program description.
   d. Written instructions for geosynthetic clay liner shipping, handling and storage.
   e. Written instructions for geosynthetic clay liner installation and quality control procedures.
   f. Panel Layout.

END OF SECTION 02275A

SECTION 02300-EARTHWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 1 Specification Sections and Special Provisions apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
1. Preparing subgrades for slabs-on-grade and lawns and grasses.
2. Excavating and backfilling for buildings, structures and retaining walls.
3. Drainage course for slabs-on-grade.
4. Subsurface drainage backfill for walls.
5. Incidental excavation and backfill for utilities located under or adjacent to structures.

B. Related Sections include the following:
1. Division 1 Section "Temporary Facilities and Controls" for temporary controls, utilities, and support facilities.
2. Division 2 Section "Site Clearing" for temporary erosion and sedimentation control measures, site stripping, grubbing, stripping and stockpiling topsoil, and removal of above- and below-grade improvements and utilities.
3. Division 2 Section 02221 "Trench Excavation and Backfill for Piplines & Appurtenant Structures.
4. Division 2 Section 02230 "Street Excavation, Backfill and Compaction"
5. Division 2 Section "Fowable Fill" for controlled low strength material.
6. Division 3 Section "Structural Concrete" for granular course if placed over vapor retarder and beneath the slab-on-grade.
7. Divisions 2, 15, and 16 Sections for installing underground mechanical and electrical utilities and buried mechanical and electrical structures.

1.3 DEFINITIONS

A. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

B. Drainage Course: Course supporting the slab-on-grade that also minimizes upward capillary flow of pore water.

C. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.
1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Engineer. Authorized additional excavation and replacement material will be paid for according to Section 01275 "Measurement and Payment or Contract provisions for changes in the Work.
2. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Engineer. Unauthorized

excavation, as well as remedial work directed by Engineer, shall be without additional compensation.

D. Fill: Soil materials used to raise existing grades.

E. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material 1 cubic yard or more in volume that exceed a standard penetration resistance of 100 blows/2 inches when tested by an independent geotechnical testing agency, according to ASTM D 1586.

F. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

G. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, drainage fill, or topsoil materials.

H. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.4 SUBMITTALS

A. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated:
1. Classification according to ASTM D 2487 of each on-site and borrow soil material proposed for fill and backfill.
2. Laboratory compaction curve according to ASTM D 698 for each on-site and borrow soil material proposed for fill and backfill.

B. When, in the opinion of the Engineer, the field soil conditions differ from those represented by the material test reports, new samples shall be taken by the Contractor and delivered to the testing agency for classification and laboratory compaction curve testing. All testing shall be based on the appropriate soil test results.

1.5 QUALITY ASSURANCE

Geotechnical Testing Agency Qualifications: An independent testing agency qualified according to ASTM E 329 to conduct soil materials and rock-definition testing, as documented according to ASTM D 3740 and ASTM E 548.

1.6 PROJECT CONDITIONS

A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by Engineer and then only after arranging to provide temporary utility services according to requirements indicated.
1. Notify Engineer not less than two weeks in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Engineer's written permission.
3. Contact utility-locator service for area where Project is located before excavating.

B. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies to shut off services if lines are active.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.

B. Satisfactory Soils (under roads, trails, structures, and parking areas) : ASTM D 2487 Soil Classification Groups GW, GP, GC, GM, SW, SM and SP or a combination of these groups; with 95% less than 6 inches (75 mm) in any dimension; and free of debris, waste, frozen materials, vegetation, and other deleterious matter.

C. Satisfactory Soils (outside of roads, trails, structures and parking areas): ASTM D 2487 Soil Classification Groups GW, GP, GC, GM, SW, SP, SC, SM, ML, and CL or a combination of these groups; with 95% less than 6 inches (75 mm) in any dimension; and free of debris, waste, frozen materials, vegetation, and other deleterious matter.

D. Unsatisfactory Soils: Soil Classification Groups OL, CH, MH, OH, and PT according to ASTM D 2487, or a combination of these groups.

E. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.

F. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; except with 100 percent passing a 1-inch (25-mm) sieve and not more than 8 percent passing a No. 200 (0.075-mm) sieve.

G. Drainage Course: Narrowly graded mixture of washed crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 3/4-inch (37.5-mm) sieve and 0 to 5 percent passing a No. 8 (2.36-mm) sieve.

H. Filter Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; ASTM D 448; coarse-aggregate grading Size 67; with 100 percent passing a 1-inch (25-mm) sieve and 0 to 5 percent passing a No. 4 (4.75-mm) sieve.

I. Sand: ASTM C 33; fine aggregate, natural, or manufactured sand.

J. Fine grained Liner Subgrade: Naturally or artificially graded mixture of soil with 100 percent passing a 1/2 inch sieve and 50 percent passing a No. 200 Sieve.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

B. Preparation of subgrade for earthwork operations including removal of vegetation, topsoil, debris, obstructions, and deleterious materials from ground surface is specified in Division 2 Section "Site Clearing."

C. Protect and maintain erosion and sedimentation controls, which are specified in Division 2 Section "Site Clearing," during earthwork operations.

D. Provide protective insulating materials to protect subgrades and foundation soils against freezing temperatures or frost.

3.2 DEWATERING

A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.

B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.
   1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.
   2. If required, install a dewatering system to keep subgrades dry and convey ground water away from excavations. Maintain until dewatering is no longer required.

3.3 EXPLOSIVES

Explosives: Do not use explosives.

3.4 EXCAVATION, GENERAL

A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized regardless of the character of surface and subsurface conditions encountered.
   1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.
   2. If rock is encountered within excavations, cease work in the area where rock is discovered until a time and materials change order for the extra work can be agreed upon by the Contractor, Owner and Engineer. The work in the affected area will again proceed after a change order is processed, and no shutdown time or associated additional costs will be awarded other than those agreed upon in the change order.

3.5 EXCAVATION FOR STRUCTURES

A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch (25 mm). If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.
   1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.
   2. Pile Foundations: Stop excavations 6 to 12 inches (150 to 300 mm) above bottom of pile cap before piles are placed. After piles have been driven, remove loose and displaced material. Excavate to final grade, leaving solid base to receive concrete pile caps.

3. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Utility Structures: Excavate to elevations and dimensions indicated within a tolerance of plus or minus 1 inch (25 mm). Do not disturb bottom of excavations intended as bearing surfaces.

3.6 SUBGRADE INSPECTION

A. Notify Engineer when excavations have reached required subgrade.

B. If Engineer determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.

C. Proof-roll subgrade below the building slabs and pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
1. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph (5 km/h).
2. Proof-roll with a loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons (13.6 tonnes).
3. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Engineer, and replace with compacted backfill or fill as directed.

D. Authorized additional excavation and replacement material will be paid for according to Contract provisions.

E. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Engineer, without additional compensation.

3.7 UNAUTHORIZED EXCAVATION

A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2500 psi (17.2 MPa), may be used when approved by Engineer.
1. Fill unauthorized excavations under other construction or utility pipe as directed by Engineer.

3.8 STORAGE OF SOIL MATERIALS

A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.9 BACKFILL

A. Place and compact backfill in excavations promptly, but not before completing the following:
1. Construction below finish grade including, where applicable, subdrainage, dampproofing, waterproofing, and perimeter insulation.

2. Surveying locations of underground utilities for Record Documents.
3. Testing and inspecting underground utilities.
4. Removing concrete formwork.
5. Removing trash and debris.
6. Removing temporary shoring and bracing, and sheeting.
7. Installing permanent or temporary horizontal bracing on horizontally supported walls.

B. Place backfill on subgrades free of mud, frost, snow, or ice.

3.10 SOIL FILL

A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.

B. Place and compact fill material in layers to required elevations as follows:
1. Under grass and planted areas, use satisfactory soil material.
2. Under steps and ramps, use Structural Fill.
3. Under building slabs, use Structural Fill.
4. Under footings and foundations, use Structural Fill.
5. Under and adjacent to retaining walls, use Structural Fill.
6. In utility trenches within 5 feet of any retaining wall or foundation, use Structural Fill.

C. Place soil fill on subgrades free of mud, frost, snow, or ice.

3.11 SOIL MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.
1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
2. Remove and replace, or scarify and air dry otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.12 COMPACTION OF SOIL BACKFILLS AND FILLS

A. Place backfill and fill soil materials in layers not more than 8 inches (200 mm)] in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches (100 mm) in loose depth for material compacted by hand-operated tampers.

B. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.

C. Where backfill is to extend higher on one side than on the other, as indicated on the Plans, structural floor beams or other means of restraint shall be installed before such backfill is placed. Should any deflection of the foundation wall result form the Contractor's failure to provide adequate bracing, the Contractor shall remove the backfill or embankment to relieve the deflection, properly brace the wall, and replace the backfill at not additional cost to the Owner.

D. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 698:
   1. Under structures, building slabs and steps, scarify and recompact top 12 inches (300 mm) of existing subgrade and each layer of backfill or fill soil material at 98 percent.
   2. Under lawn or unpaved areas, scarify and recompact top 6 inches (150 mm) below subgrade and compact each layer of backfill or fill soil material at 90 percent.
   3. Under roads, trails, and parking areas, scarify and recompact top 6 inches (150 mm) below subgrade and compact each layer of backfill or fill soil material at 95 percent.

3.13 GRADING

A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
   1. Provide a smooth transition between adjacent existing grades and new grades.
   2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.

B. Site Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:
   1. Lawn or Unpaved Areas: Plus or minus [1 inch (25 mm)]

C. Grading inside Building and Structure Lines: Finish subgrade to a tolerance of 1/2 inch (13 mm) when tested with a 10-foot (3-m) straightedge.

3.14 SUBSURFACE DRAINAGE

A. Subsurface Drain: Place subsurface drainage geotextile around perimeter of subdrainage trench. Place a 6-inch (150-mm) course of filter material on subsurface drainage geotextile to support subdrainage pipe. Encase subdrainage pipe in a minimum of 12 inches (300 mm) of filter material, placed in compacted layers 6 inches (150 mm) thick, and wrap in subsurface drainage geotextile, overlapping sides and ends at least 6 inches (150 mm).
   1. Compact each filter material layer to 85 percent of maximum dry unit weight according to ASTM D 698

3.15 DRAINAGE COURSE

A. Place drainage course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place and compact drainage course under cast-in-place concrete slabs-on-grade and under water storage reservoir floors as follows:
   1. Install subdrainage geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
   2. Place drainage course 6 inches (150 mm) or less in compacted thickness in a single layer.
   3. Place drainage course that exceeds 6 inches (150 mm) in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches (150 mm) thick or less than 3 inches (75 mm) thick.

4. Compact each layer of drainage course to required cross sections and thicknesses to not less than 95 percent of maximum dry unit weight according to ASTM D 698.

3.16 FINE GRAINED LINER SUBGRADE

A. Install fine grained liner subgrade under PVC liner in Water Storage Reservoir underdrain system.

B. Surface shall be smooth and free of all rocks and stones greater than ½ inch in diameter, sticks, sharp objects, or debris of any kind. The surface shall be smooth, flat , firm, unyielding foundation for the geomembrane with no sudden, sharp, or abrupt changes or break in grade.

C. Compact soil materials to not less than the following 95 percent of maximum dry unit weight according to ASTM D 698

3.17 FIELD QUALITY CONTROL

A. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Engineer.

B. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable. Tests will be performed at the following locations and frequencies:
1. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least 1 test for every 1000 sq. ft. or less of building slab, but in no case fewer than 3 tests.
2. Foundation Wall Backfill: At each compacted backfill layer, at least 1 test for each [100 feet (30 m)] or less of wall length, but no fewer than 2 tests.

C. When testing reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil to depth required; recompact and retest until specified compaction is obtained.

3.18 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.
1. Scarify or remove and replace soil material to depth as directed by Engineer; reshape and recompact.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.19 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Owner's property. Municipal waste encountered during excavations shall be subject to the terms of Section 01000 - Special Provisions.

END OF SECTION 02300

SECTION 02378-RIPRAP

PART 1 - GENERAL

1.1 DESCRIPTION

This work consists of furnishing and placing riprap rock for bank protection, slope protection, drainage structures, and erosion control.

1.2 PRODUCTS

1.3 RIPRAP

A. Furnish riprap as indicated on the Drawings and according to the following table.

Class	Percent of Rock by Mass	Mass (pounds)	Approximate Cubic Dimension (inches)
1	20	22 to 33	6 to 8
	30	11 to 22	5 to 6
	40	1 to 11	2 to 5
	10 (1)	0 to 1	0 to 2
2	20	55 to 110	8 to 10
	30	22 to55	6 to 8
	40	2 to 22	3 to 6
	10 (1)	0 to 2	0 to 3
3	20	220 to 330	14 to 16
	30	110 to 220	10 to 14
	40	11 to 110	5 to 10
	10 (1)	0 to 11	0 to 5
4	20	550 to 770	18 to 20
	30	220 to 550	14 to 18
	40	22 to 220	6 to 14
	10 (1)	0 to 22	0 to 6
5	20	1540 to 2200	26 to 28
	30	770 to 1540	20 to 26
	40	55 to 770	8 to 20
	10 (1)	0 to 55	0 to 8
6	20	1870 to 3530	28 to 34
	30	1100 to 1870	22 to 28
	40	110 to 1100	10 to 22
	10 (1)	0 to 110	0 to 10

B. Furnish hard, durable, angular rock that is resistant to weathering and water action and free of organic or other unsuitable material. Do not use shale, rock with shale seams, rounded stone or boulders from a streambed source, or porous rock that may break into smaller pieces in the process of handling and placing. In no instance will concrete or other debris rock be allowed.

C. Furnish riprap free of overburden, spoil, sand, dust, organic materials, excessive cracks, mineral lenses and intrusions, or other impurities.

D. Riprap material must have a minimum specific gravity of 2.5. Assure the greatest dimension of each stone is no larger than 3 times the smallest dimension.

E. The stone will be accepted on a visual basis by the Engineer. Submit a sample for approval before placing riprap. If the stone is of questionable origin, the Engineer may require a sodium sulfate soundness test to determine its durability.

PART 2 - EXECUTION

2.1 SUBGRADE PREPARATION

A. Cut, fill, compact, and grade the subgrade surfaces to the lines and grades as shown on the Drawings prior to placing riprap, filter aggregate, bedding, or geotextiles.

B. Prepare subgrade surfaces to be reasonably smooth and free of mounds, dips, or windrows.

C. Install geotextile, conforming to MPWSS Section 02110, to maintain separation of rock material from underlying soil. Place geotextile so that it conforms closely to the subgrade but is not stretched tight. Secure filter fabric by using anchor trenches, stakes, staples, sewing, or any other means necessary according to manufacturer's recommendations.

2.2 PLACING RIPRAP

A. Prior to placement of riprap, place a layer of filter aggregate or sand bedding if specified on the Drawings. Compact and grade any required bedding layer.

B. Place riprap to its full thickness in one operation to avoid displacing the underlying material. Do not place riprap material by methods that cause segregation or damage to the prepared surface. Place or rearrange individual rocks by mechanical or hand methods to obtain a dense uniform blanket with a reasonably smooth surface.

PART 3 - MEASUREMENT AND PAYMENT

3.1 GENERAL

See Section 01275: Measurement and Payment.

END OF SECTION-02378

SECTION 02410 - INFIELD DRAINAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

1.2 DESCRIPTION OF WORK:

A. Provide subdrainage systems as shown and specified. The work includes:

1. Furnish and install composite drainage materials, piping, fittings, and accessories.
2. Drainage trenching backfill.

B. Related work:

1. Section 02225 – Irrigation Trenching and Backfill
2. Section 02460 - Infield Construction
3. Section 02820 - Lawns

1.3 QUALITY ASSURANCE:

A. Codes and Standards: Perform excavation work in compliance with applicable requirements of governing authorities having jurisdiction.

B. Testing and Inspection Service: Contractor shall provide testing as required for material submittals and approvals.

C. Grade Control: All grade control and construction staking for the work included in this specification to be provided by the Contractor, subject to approval of the Owners' Representative. If desired, the Contractor may employ, at his expense, an approved Montana licensed professional engineer or land surveyor to perform construction staking and vertical grade elevation control during all trenching and backfilling of drainage systems.

D. Obtain Owners' Representative's acceptance of installed and tested subdrainage system prior to installing drainage trench backfill materials.

1.4 SUBMITTALS:

A. Test Reports-Excavating: Submit the following reports directly to Owner's Representative from the testing services, with copy to Contractor:

1. Test reports on sand used for composite drain cover material.

B. Submit manufacturer's product data for each type of drainage pipe or material required. Show types and sizes of fittings and accessories proposed for the work.

C. Submit shop drawings for all special fabrications.

1.5 JOB CONDITIONS:

A. Site Information: Data on indicated subsurface conditions are not intended as representations or warranties of accuracy or exact as-built conditions. Data is provided strictly as a guide to the Contractor.

B. Existing Utilities: Locate all existing utilities in areas of work, including existing irrigation systems, or verify location of utilities with appropriate authorities. Data on indicated utilities and their locations are not intended as representations or warranties of accuracy. It is expressly understood that neither the Owner nor the Architect will be responsible for interpretations or conclusions drawn therefrom by the Contractor.

1. If utilities are to remain in place, provide adequate means of support and protection during trenching and backfilling operations.

2. Should any piping or other utilities be encountered during excavation, consult utility owner immediately for directions. Cooperate with Owner and utility companies in keeping respective services and facilities in operation. Repair damaged utilities to satisfaction of utility owner without cost to Owner.

3. Do not interrupt existing utilities serving facilities occupied and used by Owner or others, except when permitted and then only after acceptable temporary utility services have been provided. Provide minimum of 48 hours notice to Owners' Representative, and receive written notice to proceed before interrupting any utility.

C. Use of Explosives: The use of explosives is not permitted.

D. Protection of Persons and Property: Barricade open excavations and trenches occurring as part of this work and post with warning lights. During the contract period barricade the site with warning tape.

Operate warning lights as recommended by authorities having jurisdiction.

Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout and other hazards created by earthwork operations.

PART 2 - PRODUCTS

2.1 MATERIALS:

A. Subdrainage materials: Provide types and sizes indicated. Provide matching reducers, adaptors, couplings, fittings, and accessory components to ensure continuity of the subdrainage system.

1. Transport pipe & fittings: ASTM F2648, N-12 WT IB corrugated polyethylene drainage tubing, as manufactured by ADS, or approved equal. Fittings shall be of the same manufacturer and water tight.

2. Composite Drain Collection System: Multi-flow, as manufactured by Varicore Technologies, Inc., telephone 800-978-8007, or approved equal. All fittings shall be manufactured by Varicore.

B. Composite Drain Cover: All sand cover to meet the following minimum gradation standards:

- Less than 5% retained on a #10 sieve.
- Less than 5% passing a #30 sieve.
- No more than 1% passing a #50 sieve.

C. All other materials, not specifically described but required for a complete and proper drainage system installation, shall be new, first quality of their respective kinds, and subject to the approval of the Owner's Representative.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS:

A. Inspection

Prior to all work of this section, carefully inspect the existing site conditions, the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence. Examine substrates and installation conditions. Do not start subdrainage work until unsatisfactory conditions are corrected.

Verify that drainage system installation may be completed in accordance with the original design and the referenced standards.

B. Discrepancies

In the event of discrepancy, immediately notify the Owner's Representative.

Do not proceed with installation in areas of discrepancy until all discrepancies have been fully resolved.

Beginning of installation means acceptance of existing conditions by installer.

3.2 INSTALLATION:

A. Base Conditions

Confirm grades meet tolerances specified in section 02460 prior to beginning work.

B. Trenching and Backfill

All trenching and backfill shall conform to the requirements of section 02225 of this specification except that all composite drain bedding and backfill shall be as specified by this section. Backfill of transport lines shall be as specified by section 02225.

Provide uniformly sloping trenches with a compacted earth base. Hand trim excavations to required elevation if necessary. Place and compact earth fill as required to fill low areas and provide a positive drainage flow.

C. Composite Drain Collection System

Install all composite drain as shown on the plans. Provide constant slope between given control elevations.

Minimum clearance between finish grade and all composite drain shall be 10 inches.

Strictly follow manufacturers recommendations for installation and connections. Exercise care to assure that joints are firmly butted to allow free flow. Seal all joints with manufacturer's PVC tape.

Do not allow backfill material to become contaminated with native soil materials. Any area so contaminated shall be immediately removed and replaced to the satisfaction of the Owners' Representative.

Where specified, lay composite drain down, joints closed, and firmly bedded in drainage fill material. Provide full bearing for each pipe section. Provide continuous slope in the direction of flow. Provide proper fittings for all in-line joints and ell, elbow, or bend sections for all corners and changes in direction. Fittings shall be installed in accordance with the manufacturer's recommendations.

Provide non-perforated transport pipe. Extend drainage system to out fall indicated and make connection.

Obtain required inspections and perform testing before backfilling. Remove obstructions, replace damaged components and retest system as required. Provide a satisfactory free flowing subdrainage system.

3.3 CLEANING:

A. Upon completion of subdrainage work, remove tools and equipment. Provide site clear, clean, free of debris, and suitable for occupation by the Owner.

END OF SECTION

SECTION 02460 - INFIELD CONSTRUCTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

1.2 DESCRIPTION OF WORK:

A. Provide infield and warning track playing surface as shown and specified. The work includes:

1. Subgrade preparation.

2. Deliver Owner provided materials for new infield base and infield and warning track surfacing. Furnish all mixing materials and installation, including consolidation and fine grading.

B. Related work:

1. Section 02225 - Trenching and Backfill

2. Section 02410 – Infield Drainage

1.3 QUALITY ASSURANCE:

A. Codes and Standards: Perform excavation work in compliance with applicable requirements of governing authorities having jurisdiction.

B. Testing and Inspection Service: Owner will engage soil testing and inspection service for compaction quality control testing during construction. Contractor to coordinate testing.

Contractor shall engage soil testing service for all testing as required for material submittals, including all gradation testing, and approvals. Testing shall be performed by a qualified independent laboratory. Laboratory subject to approval by Owner's Representative.

C. Grade Control: General site layout to be provided by the Owner. Infield and warning track grade control and construction staking required by this specification to be provided by the Contractor, subject to approval of the Owners' Representative. If desired, the Contractor may employ, at his expense, an approved Montana licensed professional engineer or land surveyor to perform construction staking and vertical grade elevation control.

D. Obtain Owners' Representative's acceptance of subgrade conditions prior to installing new infield materials.

1.4 REFERENCED STANDARDS:

A. Comply with the current applicable provisions of all codes, standards and specifications

referenced in this section, except as modified by the requirements of these Contract Documents, including, but not limited to, the following:

ASTM F 2107-08 – Standard Guide for Construction and Maintenance of Skinned Areas on Baseball and Softball Fields.

1.4 SUBMITTALS:

Test Reports: Submit following reports directly to Owners' Representative from the testing services, with copy to Contractor:

1. Test reports on mixed infield material gradation.

2. Submit specifications for machinery to be used in manufacture and mixing infield surfacing materials, including screens and soil shredders or pug mill.

1.5 JOB CONDITIONS:

A. Site Information: Data on indicated subsurface conditions are not intended as representations or warranties of accuracy or exact as-built conditions. Data is provided strictly as a guide to the Contractor.

B. Existing Utilities: Locate all existing utilities in areas of work, including existing irrigation systems, or verify location of utilities with appropriate authorities. Data on indicated utilities and their locations are not intended as representations or warranties of accuracy. Neither the Owner nor the Owner's Representative will be responsible for interpretations or conclusions drawn therefrom by the Contractor.

1. If utilities are to remain in place, provide adequate means of support and protection during trenching and backfilling operations.

2. Should any piping or other utilities be encountered during excavation, consult utility owner immediately for directions. Cooperate with Owner and utility companies in keeping respective services and facilities in operation. Repair damaged utilities to satisfaction of utility owner without cost to Owner.

3. Do not interrupt existing utilities serving facilities occupied and used by Owner or others, except when permitted and then only after acceptable temporary utility services have been provided. Provide minimum of 48 hours notice to Owners' Representative, and receive written notice to proceed before interrupting any utility.

C. Use of Explosives: The use of explosives is not permitted.

D. Protection of Persons and Property: Barricade open excavations and trenches occurring as part of this work and post with warning lights. During the contract period barricade the immediate site with warning tape.

Operate warning lights as recommended by authorities having jurisdiction.

Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout and other hazards created by earthwork operations.

PART 2 - PRODUCTS

2.1 MATERIALS:

A. Infield and warning track materials: Provide types indicated. Final mixture of infield and warning track material proportions subject to adjustment based on availability of materials and any deviation from specifications.

1. Infield Base: Decomposed granite provided by Owner.

2. Infield and Warning Track Surfacing: Decomposed granite provided by Owner. Material shall be screened and mixed as required by this specification.

3. Sand: As provided by Contractor to produce specified surfacing.

4. Silt: As provided by Contractor to produce specified surfacing.

5. Clay: As provided by Contractor to produce specified surfacing.

B. Loading, hauling, and processing of Owner provided materials shall be the Contractor's responsibility.

C. All other materials, not specifically described but required for a complete and proper infield surfacing installation, shall be new, first quality of their respective kinds, and subject to the approval of the Owner's Representative.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS:

A. Inspection

Prior to all work of this section, carefully inspect the existing site conditions, the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence. Examine substrates and installation conditions. Do not start work until unsatisfactory conditions are corrected.

Verify that infield installation may be completed in accordance with the original design and the referenced standards.

B. Discrepancies

In the event of discrepancy, immediately notify the Owner's Representative.

Do not proceed with installation in areas of discrepancy until all discrepancies have been fully resolved.

3.2 COMPACTION:

A. General: Control compaction during construction providing minimum percentage of density specified for each area classification indicated below.

B. Percentage of Maximum Density Requirements: Compact soil to not less than the following percentages of maximum dry density determined in accordance with ASTM D 698.

1. Subgrade: Proof roll subgrade at infield and warning track. Remove and replace any yielding material. Compact subgrade to 95% of maximum dry density prior to installation of composite drain system.

2. Infield Base: Roll with smooth drum type roller to stable condition. Compact to 90% of maximum density.

3. Infield and Warning Track Surfacing: Place material with moisture condition favorable for compaction. Compact to 90% of maximum density.

C. Moisture Control: Where material must be moisture conditioned before compaction, uniformly apply water to surface of subgrade, or layer of soil material. Apply water in manner to prevent free water appearing on surface during or subsequent to compaction operations.

Remove and replace, or scarify and air dry, material that is too wet to permit compaction to specified density.

3.3 GRADING:

A. General: Uniformly grade areas within limits of grading under this section, including adjacent transition areas. Smooth finished surface within specified tolerances, compact with uniform levels or slopes between points where elevations are indicated, or between such points and existing grades.

B. Grading Infield and Warning Track Area: Finish surfaces free from irregular surface changes, and as follows:

1. Subgrade: Grading tolerance for subgrade shall be ± 0.05 foot in ten feet. Secure approval of Owner's Representative before installing composite drain system.

2. Infield Base: Grading tolerance for infield base material shall be ± 0.05 foot in twenty feet. Secure approval of Owner's Representative before installing infield surfacing.

3. Infield and Warning Track Surfacing: Grading tolerance for infield surface shall be ± 0.05 foot in twenty feet. During placing operations continually shoot grades from established monument as material is placed to assure uniform in place thickness.

C. Compaction: Compact material to the depth and indicated percentage of maximum or relative density and specified moisture content for each area classification.

3.4 INSTALLATION:

A. Subgrade Conditions

Following approval of grades, bluetop or otherwise set controls minimum 20 feet O.C. prior to placement of infield base material and warning track surfacing.

B. Composite Drain System

Install composite drain system at infield as shown on the plans and as specified by Section 02410 - Infield Drainage.

C. Infield Base

Infield base material shall be placed with crawler or other high flotation equipment to avoid loss of subgrade grades and to prevent damage to composite drain system. Do not back loaded trucks out onto base material. Secure approval of Owner's Representative before installing infield surfacing.

Following approval of grades, bluetop or otherwise set controls minimum 20 feet O.C. prior to placement of infield surface material.

D. Infield Playing Surface and Warning Track Surfacing

1. General

The intent of this specification is to produce a free draining, friable, workable, smoothly textured playing surface that is resistant to compaction yet binds well enough for good footing and playability.

The Contractor shall secure suitable materials, in addition to Owner provided decomposed granite, subject to approval, to create the desired infield surface material. Contractor shall perform a minimum of five gradation tests for each material source used, including Owner provided materials, to develop a source average.

Run out a sample mixture, minimum 10 cubic yards, using approved materials and proposed methods, for approval. Do not proceed with production of infield or warning track surface material until the sample has been tested and approved in writing by the Owner's Representative.

Infield and warning track mix shall be created in four separate batches, one per field. Each batch shall be tested by the Contractor and approved by the Owner's representative in writing before installation.

The following specifications are intended as a guideline.

2. Infield and Warning Track Mix Manufacture

All blending and mixing of materials is to be accomplished with a pug mill, soil shredder, or other approved machine specifically designed for that purpose. **Mixing in place will not be permitted.**

Crush and screen raw materials as required to meet gradation specifications (including any modifications necessitated by materials availability).

Thoroughly mix materials, or adjust mixture as required by Owner's Representative. Thoroughly mix materials in proportions recommended by the testing laboratory to produce final mixture. Final mixture shall conform to the following gradation and specifications:

Sieve Size	Particle Size, mm	Percent Passing	
		*Owner Supplied Decomposed Granite	Specified Surfacing Mix
3/8"	9.530	100	100
No. 4	4.750	98	100
No. 10	2.00	86	83 - 93
No. 18	1.00	59	72 - 82
No. 35	0.500	30	60 - 68
No. 60	0.250	10	44 - 50
No. 80	0.180	5.7	36 - 40
No. 100	0.150	4.5	32 - 36
No. 200	0.075	2.8	23 - 27
No. 270	0.053	2.4	22 - 26

* Gradation provided for informational purposes only. Contractor shall perform testing on Owner supplied decomposed granite prior to beginning work.

3. Installation

Following approval of infield surfacing sample run, set a benchmark monument prior to placement of infield.

Infield and warning track surfacing shall be placed by back dumping and spreading the material with crawler or other high flotation equipment over the base to avoid loss of base grades. **Do not back loaded trucks out onto base.**

Any damage to base grades occurring during placement of infield surfacing shall be repaired immediately, and approved by the Owner's Representative, before continuing placement operations. Continue infield surface placement after base repair approval.

4. Finishing

Following placement of all infield surface material, finish the infield by working the material, floating and dragging until smooth even surfaces result. Provide additional infield surfacing material as required to make up for loss due to compaction and finishing. Final drag as necessary to meet approval of the Owner's Representative.

Infield striping, base anchors and base installation by others.

5. Additional Material

Continue mixing infield material following fill of all fields. Provide minimum 50 cubic yards excess infield mix. Stockpile excess mix off-site as directed by the Owner's Representative.

3.7 FIELD QUALITY CONTROL

A. Quality Control Testing During Construction: Notify Owner's Representative and testing service to inspect and approve subgrades and fill layers before further construction work is performed.

Perform field density tests in accordance with ASTM D 698.

1. Subgrade: Any areas that are removed and recompacted during proof roll operation shall be tested. Subsequent verification and approval of each subgrade area may be based on a visual comparison of each subgrade with related tested strata, when acceptable to Owner's Representative.

2. Infield and Warning Track Surfacing: Make at least one field density test of surfacing for every 2000 sq. ft. of infield and warning track area, not less than 3 tests per field.

3. If in the opinion of the Owner's Representative, based on testing service reports and inspection, subgrade or fills which have been placed are below specified density, provide additional compaction and testing at no additional expense.

3.3 CLEANING:

Upon completion of the work, the entire site shall be cleared of all debris, and ground surfaces shall be finished to smooth, uniform slopes and shall present a neat and workmanlike appearance. Cleanup shall be considered an incidental item, and no additional payment shall be made for any cleanup item. All fences, culverts, gravel driveways or other obstructions removed during construction, shall be replaced in a condition at least equal to their preconstruction condition.

In all proposed turf areas, fill any depressions created by construction traffic with approved topsoil.

The Owner's Representative shall approve all site conditions prior to final payment.

3.8 MAINTENANCE:

The Contractor shall, for a period of one (1) year after completion and final acceptance of the work, maintain and repair any infield settlement which may occur, and shall make suitable repairs to any pavements, sidewalks, fences, backstops or other structures which may become damaged as a result of settlement. All such maintenance and repair shall be at the Contractor's expense.

END OF SECTION

SECTION 02665-HDPE PIPING

PART 1 - GENERAL

1.1 DESCRIPTION

Furnish and install high density polyethylene (HDPE) pipe and fittings including manholes, service lines, and other appurtenant structures as specified in the Contract and this section. Pipe strength classifications are specified on the plans, listed in the Contract Documents, or specified herein.

1.2 REFERENCES

ASTM F714	Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter
ASTM D3035	Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter
ASTM D3350	Polyethylene Plastic Pipe and Fittings Material
AWWA C901	Polyethylene (PE) Pressure Pipe and Tubing, ½ In.Through 3 In.
AWWA C906	Polyethylene (PE) Pressure Pipe and Fittings , 4 In. Through 63 In.

1.3 STANDARD DRAWINGS

Standard Drawing No. 02660-2: Water and Sewer Main Separation

1.4 CONTRACTOR QUALIFICATIONS

A. HDPE pipe thermal fusion welding and installation must be done by a firm or individual(s) having demonstrated satisfactory certification and performance history in the installation of HDPE pipe. If subcontracted, the firm or individual(s) will be responsible to the Contractor for all phases of HDPE pipe installation.

B. Submit the following information within 5 calendar days of the Bid Opening.
   1. Copies of current factory certification(s) for the Contractor, or proposed Subcontractor, for the installation and thermal fusion welding of HDPE pipe in accordance with Code of Federal Regulations (CFR) Title 49 and Part 192.285.
   2. A list of similar work completed by the Contractor, or proposed Subcontractor, within the last 2 years that totals the installation of at least 1 mile (1.6 km) of 4 inch (100 mm) diameter or greater HDPE pipe using thermal fusion welded joints.

C. Failure by a prospective Bidder to submit the required information within the allotted time will be deemed a material irregularity, which may result in the bid being determined non-responsive and rejected.

D. The information provided will be evaluated by the Owner and Engineer to determine if the experience and qualifications submitted are adequate to perform the work. The Owner and Engineer's interpretation of Contractor or Subcontractor's ability to perform the work will be final.

E. The information may be submitted to the Engineer up to 10 days before the bid opening for prequalification.

PART 2 - PRODUCTS

2.1 GENERAL

A. Furnish all HDPE piping as specified in the Contract Documents and meeting the materials and testing requirements of this Section. Furnish all fittings of the same material and design as the specified piping. Furnish the pipe sizes and strength classifications shown in the Contract documents.

B. References to ASTM, or AASHTO designation, means the latest revision at the time of call for bids.

C. Assure all pipe is clearly marked with type, class and/or thickness as applicable. Assure lettering is legible and permanent under normal handling and storage conditions.

D. Furnish a manufacturer's certification for all pipe and fittings, certifying that the pipe and fittings meet the contract requirements.

2.2 HIGH DENSITY POLYETHYLENE PIPE (HDPE)

A. Furnish HDPE pipe meeting AWWA C901 or C906 and ASTM D3350, with a material designation code of PE 3408, a cell classification of PE 34-5434C, and a DR of 11.

B. Assure HDPE pipe is manufactured with an ultraviolet (UV) stabilizer.

C. Furnish pipe with iron pipe size (IPS) outside diameters. Assure dimensions and workmanship meet ASTM F714 requirements for nominal diameters of 4 inches (100 mm) or greater and ASTM D3035 for nominal diameters smaller than 4 inches (100 mm).

D. Assure all HDPE pipe used in potable water applications is NSF approved.

2.3 FITTINGS

A. Use tee or wye fittings for connecting service lines of the same material, construction, and joint design as the main pipe.

B. Furnish special fittings meeting the Contract Documents.

2.4 PIPE JOINTING

A. Thermally fuse HDPE pipe and fittings by one of the following types of thermal fusion per the manufacturer's recommended procedures: butt fusion, saddle fusion, or socket fusion.

B. Thoroughly clean all pipe segments prior to fusing to assure no HDPE pieces remain in the pipe (these pieces may clog air valves).

C. HDPE pipe and fittings may be joined together through the use of electrofusion fittings with the Engineer's approval.

D. Join HDPE pipe and fittings to other materials with flange adapters with back-up rings, mechanical couplings designed for connecting HDPE pipe and fittings to another material, or mechanical joint adapters. Consult the manufacturer of the joining device for proper installation procedures.

2.5 WATER SERVICE CONNECTIONS

A. For water service taps to HDPE, use corporation stops with CPEX polypropylene ball valve with PE 3408 base with butt fusion adaptor for saddle fusion installation and compression adaptor on outlet.

B. Do not use bolt on service clamps for water service connections to HDPE.

PART 3 - EXECUTION

3.1 PIPE LINE INSTALLATION

A. Excavation and Backfill
1. Excavate and backfill pipelines meeting the applicable portions of SECTION 02221: TRENCH EXCAVATION AND BACKFILL FOR PIPELINES AND APPURTENANT STRUCTURES.

B. Responsibility for Materials
1. The Contractor is responsible for all material furnished. Replace all material found defective in manufacture or damaged in handling after delivery. This includes furnishing all material and labor required for the replacement of installed material discovered defective before final acceptance of the work or during the guarantee period.
2. The Contractor is responsible for the safe storage of material intended for the work until it has been incorporated in the completed project.

C. Handling of Pipe
1. Deliver and distribute all pipe to the site. Load and unload pipe, fittings and accessories by lifting with hoists or skidding to avoid shock or damage. Do not drop any materials. Do not roll or skid pipe handled on skidways against pipe already on the ground.
2. In distributing the material at the site of the work, unload each piece opposite or near the place where it is to be laid in the trench. Keep the interior of all pipe and other accessories free from dirt and foreign matter at all times.
3. Repair or replace all damaged pipe at Contractor's expense on the jobsite.

D. Laying Pipe
1. Lay and maintain all pipe to the specified lines and grades with fittings at the specified locations.
2. Use tools and equipment, satisfactory to the Engineer, for the safe and convenient prosecution of the work. Carefully lower all pipe and fittings into the trench to prevent damage to the pipe materials and protective coatings and linings. Do not drop or dump any materials into the trench.
3. Take every precaution to prevent foreign material from entering the pipe while it is being installed. At times when pipe laying is not in progress, close the open ends of the pipe using a plug or other means approved by the Engineer. Clean and remove all sand, gravel, concrete and cement grout that has entered the lines during construction.
4. Place pipe bedding in the bottom of the trench meeting Section 02221; TRENCH EXCAVATION AND BACKFILL FOR PIPELINES & APPURTENANT STRUCTURES. Voids may be left in the bedding material to remove pipe slings to allow support along the full length of the pipe barrel.

5. Join sections of HDPE into continuous lengths above ground. Assure the equipment used to join pipe sections shall be capable of meeting all conditions recommended by the pipe manufacturer, including but not limited to, temperature requirements of a minimum of 400 degrees Fahrenheit (204° C), alignments, and an interfacial fusion minimum pressure of 75 pounds per square inch (517 kPa).
6. Cut pipe for inserting fittings in a neat and workmanlike manner without damaging the pipe or coating and leaving a smooth end at right angles to the pipe axis. Do not cut pipe using an oxyacetylene torch.

E. Tolerances
1. Install the pipe within ½ inch (13 mm) of the specified alignment and within ¼ inch (6 mm) of the specified grade.

3.2 Thermal Fusing HDPE

A. Butt Fusion
1. Clean pipe ends thoroughly with cotton cloth. Assure no HDPE cuttings remain in the pipe. Face the pipe ends to establish clean, parallel mating surfaces. Continue facing until a minimal distance exists between the fixed and movable jaws of the machine and the facer is locked firmly and squarely between the jaws. Provide a perfectly square face, perpendicular to the pipe centerline on each pipe end and with no detectable gap.
2. Align and round the pipe profiles with each other to minimize mismatch (high-low) of the pipe walls. Clamping jaws must not be loosened during fusion. Clamp the pipe as close to the joint area as possible to ensure proper pipe alignment.
3. Use heating tool with internal thermometer, assuring heater faces are clean, oil-free, and coated with a nonstick coating as recommended by the manufacturer. Periodically verify the proper surface temperature using a using a pyrometer or surface temperature measuring device. Melt the pipe interfaces until the proper bead size is formed per manufacturer's recommended temperature and bead size, without applying pressure.
4. Join the pipe ends rapidly, but carefully, with sufficient pressure to mix the pipe materials and form a homogenous joint. Follow manufacturer's recommendations for internal pressure or bead size of molten material.
5. Hold molten joint immobile under pressure as indicated until cooled adequately to develop strength. Use cooling times established by the pipe manufacturer. Do not apply water, wet cloths, or similar to shorten cool time.
6. Each fused joint must have a complete double roll-back bead and be inspected by Contractor personnel with qualifications approved under Section 02665.1.5.

B. Saddle/Sidewall Fusion
1. Remove any dirt or coating that might interfere with the proper installation of the fusion machine.
2. Install the proper size heater saddle adaptors on the heater plate. Do not over tighten, but insure that mating surfaces of the heater and adapters are clean and flush. Heat the plates to the temperature specified by the pipe and fitting manufacturer.
3. Install the saddle fusion machine to the pipe using appropriate tooling and the manufacturer's instructions to straighten and round the pipe. Do not flatten pipe when tightening clamping fixture.

4. Clean and roughen pipe surface and fitting saddle contour with 50 or 60 grit utility cloth to expose fresh material. Brush away residue with a clean, dry cloth after roughening the surfaces. Do not use sandpaper or other abrasive materials that are likely to leave grit or deposits of other foreign materials on the pipe surface.
5. Position the fitting on the pipe and place the fitting into the saddle-fitting holding insert. Apply a slight downward force on the fitting and inspect to insure a precise fit to the pipe. Move the fitting away from the pipe, then back to the pipe and inspect again for precise alignment.
6. Check the heater temperature. Periodically verify the proper surface temperature using a using a pyrometer or surface temperature measuring device. Place the heater tool in position to heat the pipe and fitting surfaces in accordance with the pipe and fitting manufacturers' instructions.
7. Join the pipe and fitting surfaces with sufficient pressure to mix the pipe materials and form a homogenous joint. Follow manufacturer's recommendations for pressure or bead size of molten material.
8. Hold molten joint immobile under pressure as indicated in g above until cooled adequately to develop strength. Cooling times shall be established by the pipe manufacturer. Do not subject the joint to any external stresses or apply water, wet cloths, or similar to shorten cool time.
9. Each joint must be inspected by Contractor personnel with qualifications approved under Section 02665.1.5.

3.3 JOINING HDPE TO OTHER PIPE MATERIALS

A. Flanged Connections for HDPE Pipe
1. Assure all flange connections made with HDPE pipe include the placement of metal backing as recommended by the HDPE manufacturer.
2. Butt fuse the flange adapter or stub end to the plastic pipe segment. Position the flange face of the adaptor as required so that the back-up ring on the plastic pipe segment can be attached to the metal flange.
3. Snug flanges to be joined prior to bolting. Adjust pipe spool position as required to assure snug fitting prior to bolting. Install and tighten flange bolts in alternating pattern, drawing the metal and plastic flange faces evenly and flat. Do not use the flanges to draw the two pipe sections together.

B. Mechanical Compression Joints for HDPE Pipe
1. Provide mechanical joints only where specifically called for on the Drawings. Provide mechanical joints consisting of, at a minimum, a threaded compression nut or a follower and bolt arrangement, an elastomer seal ring, and a stiffener.
2. Insert pipe stiffeners to provide support under the seal ring and gripping ring. Assure stiffener is long enough to prevent collapse of the pipe.
3. Compress the seals by tightening the threaded compression nuts or follower and bolt arrangements. Assure seals are pressure-tight.
4. Each joint must be inspected by Contractor personnel with qualifications approved under Section 02665.1.5.

3.4 TESTS

A. Hydrostatic and Leakage Testing for Force Mains
1. Perform hydrostatic and leakage testing in accordance with AWWA C600 for all force mains. Once the pipe is laid and backfilled, test for at least 2 hours, all newly laid pipe, or any valved section, at the highest point along the test section. The maximum length of pip to be tested at one time shall be 3,000 linear feet

unless otherwise approved by the Engineer. Test to a hydrostatic pressure equal to the pressure rating of the pipe at the test point, but in no case less than a minimum gage pressure of 135 pounds per square inch (931 kPa) or greater than a maximum gage pressure of 200 pounds per square inch (1,379 kPa).

2. Slowly fill the pipe with water, purging all air, and apply the test pressure using a pump hooked up so that the pressure and leakage can be measured. To purge the pipe of air during the test, it is necessary to tap the pipe at its highest points if permanent air vents are not located at the high points. Use corporation stops for this purpose. Furnish the pump connections, gauges, stops, and all necessary apparatus for testing.
3. Disassemble and reassemble all joints showing leakage after thorough cleaning. Remove and replace all cracked or defective pipes or fittings discovered during the pressure test with sound material and repeat the test.
4. Conduct the leakage test concurrent with the pressure test for 2 hours. Leakage is defined as the quantity of water supplied into the pipe, or any valved section thereof, necessary to maintain pressure within 5 pounds per square inch of the pressure test after the pipe has been filled with water and purged of air.
5. The pipe installation will be rejected if the leakage exceeds that determined by the following formula:
   $L = SD(P)1/2 \div 133{,}200$
6. In which L equals the allowable leakage in gallons per hour; S is the length of pipe being tested, in feet; D is the nominal diameter of the pipe being tested, in inches; and P is the average test pressure during the leakage test, in pounds per square inch gauge.
7. Where the pipe being tested for leakage is thermally fused HDPE, the allowable leakage will be reduced to 25% of L, as calculated.
8. Should any test of pipe laid disclose leakage exceeding that specified above, locate and repair the defective joints until the leakage is within the specified allowance.
9. Conduct the pressure and leakage tests with the Engineer present.

B. Cleaning, Disinfection, and Testing Water Mains
   1. Clean, disinfect, and test HDPE used in potable water mains in accordance with Paragraphs 3.1.B through 3.1.D, as modified, in Section 02660: WATER DISTRIBUTION.

3.5 WATER AND SEWER MAIN SEPARATION

A. Assure horizontal and vertical separation between water mains and sewer mains meeting the details on Standard Drawing No. 02660-2.

3.6 WATER MAIN INSULATION

A. When crossing under, over, or within six feet of culverts that are open to the air, or in cases where less than six feet of cover is provided, provide insulation on new water mains the full width of the trench excavation. Does not apply to shallow bury areas indicated on the Drawings.

B. Furnish 2 inch thick Styrofoam HI brand plastic foam insulation (Blue Board) with tongue and groove joints or an approved equivalent. Friction fit the joints and secure with an adhesive according to the manufacturer's recommendations.

C. Place a 6 mil polyethylene sheeting over the insulation, lapping any joints a minimum of 12 inches.

D. Place a 6 inch sand cushion above and below the insulation.

PART 4 - MEASUREMENT AND PAYMENT

See Section 01275: MEASUREMENT AND PAYEMNT.

END OF SECTION 02665

SECTION 02666-PVC GEOMEMBRANE FABRICATION AND INSTALLATION

PART 1 - GENERAL

1.1 DESCRIPTION

A. Specification includes fabrication and installation of PVC geomembranes in accordance with PVC Geomembrane Institute (PGI) requirements.

B. This section includes the following:
   1. Fabrication and installation of polyvinyl chloride (PVC) geomembranes for lagoons or ponds.

C. All work shall be done in strict accordance with the drawings and these specifications and are subject to the terms and conditions of the contract. It is the intent of these specifications to ensure a first quality finished product is provided. It shall be the responsibility of the Contractor to ensure that this requirement is met. The same installation quality control, quality assurance and testing techniques are to be used for all lagoons.

1.2 REFERENCES

A. ASTM D4437, *"Standard* Practice *for Determining the Integrity of Field Seams Used in Joining Flexible Polymeric Sheet Geomembranes"*; American Society for Testing and Materials, West Conshohocken, Pennsylvania, USA.

B. ASTM D6214, "Standard test method for determining the integrity of field seams used in joining geomembranes by chemical fusion methods" ; American Society for Testing and Materials, West Conshohocken, Pennsylvania, USA.

C. ASTM D6392, "Standard test method for determining the integrity of nonreinforced geomembrane seams produced using thermo-fusion methods" ; American Society for Testing and Materials, West Conshohocken, Pennsylvania, USA.

D. ASTM D7177, "Standard test method for air-channel testing of field PVC Geomembrane Seams", American Society for Testing and Materials, West Conshohocken, Pennsylvania, USA.

E. PVC Geomembrane Institute (PGI), 2004, "PVC Geomembrane Material Specification 1104", University of Illinois, Urbana, IL, www.pvcgeomembrane.com, January 1, 2004.

1.3 SUBMITTALS

A. Submit the following to the Engineer:
   1. Documentation of the manufacturer's qualifications as specified in Section 1.4 of this specification.
   2. Manufacturer's quality control program manual.
   3. A sample property sheet, including at a minimum, all properties specified, including test method used.
   4. Sample of material.

5. Documentation of fabricator and installer's experience, as specified in these specifications.
   a. Submit a list of ten completed facilities. For each installation provide: name and type of facility; its location; the date of installation; name and telephone number of contact at the facility familiar with the geomembrane installation; type and thickness of geomembrane, type of field seaming, and surface area of installed geomembrane.
   b. Submit resumes or qualifications of fabrication manager.
   c. Fabrication quality control program.
   d. Installation quality control program.
   e. Example of material Warranty and Fabricated Seam Warranty.
   f. Copy of Manufacturer's and Fabricator's quality control program.
6. Certification and test reports as required in Section 2.7 of these specifications
7. Shop drawings
   a. Panel lay-out, identifying seams, panel size and details. Wherever possible, field seams should be oriented along the direction of the slope.
   b. Details showing the termination of the panels at the perimeter of lined areas.
   c. Methods of sealing around penetrations.
   d. Placement of the PVC lining shall not commence until the shop drawings and details have been approved by the Engineer.
8. Conformance test results
9. Additional submittals (in progress and at completion)
   a. Manufacturers warranty
   b. Fabricated seam warranty – 2 Year
   c. Field seam warranty – 2 Year
   d. Installation warranty – 2 Year
   e. Daily written acceptance of subgrade
   f. Low temperature deployment and seaming process
   g. Daily field weld test results
   h. Field seam destructive test results
   i. Field repair/patching of defects
   j. Daily field installation reports
   k. As-built drawings

1.4 QUALIFICATIONS

A. Manufacturer's qualifications: The manufacturer of the PVC geomembrane of the type specified shall have at least five years of experience in the manufacture of PVC geomembranes. In addition, the geomembrane manufacturer shall have manufactured at least one hundred million square feet (100,000,000 ft^2) of seventy two inch (72") minimum width of the specified type of geomembrane for lining hydraulic structures in the last five years.

B. Fabricators qualifications: The Fabricator of the proposed PVC geomembrane shall have a minimum one hundred million square feet (100,000,000 ft^2) of fabrication experience over the last 5 years.

C. Installer qualifications: The Geomembrane Installer shall have at least three years of experience in the installation of the specified geomembrane and shall have installed a minimum of five million square feet of the specified geomembrane on a minimum of ten projects. The installer shall be certified by the fabricator to install fabricated products.

1. Installation shall be performed under the direction of a Field Installation Supervisor who shall be responsible throughout the geomembrane installation. Responsibilities include: geomembrane panel deployment, anchorage, seaming, patching, testing, repairs, and all other daily activities of the Geomembrane Installer.
2. Seaming shall be performed under the direction of a Master Seamer (who may also be the Field Installation Supervisor or Crew Foreman) who has seamed a minimum of three million square feet of the type specified, using the same type of seaming apparatus to be used in the current project. The Field Installation Supervisor or Master Seamer shall be present whenever field seaming is being performed.
3. All seaming, patching, other welding operations, and testing shall be performed by a qualified technician employed by the Geomembrane Installer.

1.5 PACKAGING

A. Each fabricated panel delivered to the site shall be double accordion folded in both directions, wrapped with protective material, banded to heavy duty wood pallets, and labeled by the fabricator. The label or marking shall have manufacturers name, material thickness, panel identification number corresponding to panel placement layout, panel dimensions, weight, and be labeled on fabricated material as well as protective cover.

B. Panels shall be stored unopened, on a clean, level, dry area away from high traffic and protected from the direct heat of the sun.

C. Pallets shall not be stacked.

D. Whenever possible, a 6" minimum air space between the pallets should be provided, especially for an extended period of time.

1.6 ON - SITE CONDITIONS

No standing water, mud, snow, or excessive moisture will be allowed on the site. The Geomembrane will not be deployed in the presence of standing water, mud, snow, or frozen subgrade conditions. Geomembrane should not be installed while precipitation is occurring or during excessive winds, or when temperatures are outside the limits specified in section 3.3 and 3.4 of this specification.

1.7 PVC GEOMEMBRANE MATERIAL WARRANTY

The Contractor/Supplier shall provide a written warranty to the Owner that the PVC geomembrane will have a useful life of twenty years from the date of final installation and acceptance. The warranty shall state that the manufacturer will supply repair or replacement materials and labor and equipment costs on a prorated basis at the then current price in such a manner as to charge the customer only for that portion of the warranted twenty year life which has lapsed since the material was installed.

1.8 FACTORY AND FIELD FABRICATED SEAM WARRANTY

The Fabricator and Installer shall warrant factory and field fabricated seams, respectively, for a period of two (2) years after installation against defects in workmanship.

1.9 GEOMEMBRANE INSTALLATION WARRANTY

The Geomembrane Installer shall guarantee against defect in the installation and workmanship for a period of two (2) years commencing with the date of final acceptance.

1.10 GEOMEMBRANE PRE-CONSTRUCTION MEETING

A. A geomembrane Pre-Construction meeting shall be held at the site prior to installation of the PVC geomembrane. At a minimum this meeting should be attended by the Engineer, Contractor, Geomembrane Installer, Owner and the Earthwork Contractor.

B. Meeting topics should include the following:
1. Responsibilities of each party.
2. Lines of authority and communication for the project. Procedures for resolution of any project document ambiguity.
3. Methods for documenting, reporting, and distributing documents and reports.
4. Procedures for packaging and storing archive samples.
5. Review of the time schedule for all installation and testing. Schedule of workdays and/or starting times if third party testing verification is required.
6. Review of panel layout, access, numbering systems for panels, deployment, and seams including details for marking on the PVC geomembrane.
7. Procedures and responsibilities for preparation and submission of as-built drawings.
8. Temperature and weather limitations. Installation procedures for adverse weather conditions. Defining acceptable subgrade or ambient moisture and temperature conditions for working during liner installation.
9. Subgrade conditions, dewatering responsibilities, and subgrade maintenance plan.
10. Deployment techniques including allowable subgrade condition for geomembrane placement.
11. Anchor trench construction, material placement, and backfilling.
12. Plan for minimizing and addressing wrinkles, if any, in the placed geomembrane.
13. Measurement and payment schedules.
14. Covering of the Geomembrane and cover soil placement.

PART 2 - PRODUCTS

2.1 DESCRIPTION OF MATERIALS

A. The PVC geomembrane shall be constructed of 30 mil, PVC (polyvinyl chloride) geomembrane consisting of 72" minimum, widths of calendared polyvinyl chloride sheeting fabricated into large sections by means of special factory-bonded seams into a single panel, or into the minimum number of large panels required to complete the project.

B. The geomembrane shall consist of new, virgin materials and be manufactured specifically for this work and will have satisfactorily demonstrated by prior testing to be suitable and durable for such purposes.

2.2 PHYSICAL CHARACTERISTICS

A. Geomembrane shall be uniform in color, size, and thickness. The material shall have the minimum physical property characteristics, as outlined in the specifications. Certified

test results showing that the sheeting meets or exceeds the specifications shall be supplied

B. The finished geomembrane shall have the minimum property values listed in the following table:

Certified Properties	ASTM	PVC 20	PVC 30	PVC 40	PVC 50
Thickness	D-5199	20 ±1 mil 0.51 ± .03 mm	30 ±1.5 mil 0.76 ± .04 mm	40 ±2 mil 1.02 ± .05 mm	50 ±2.5 mil 1.27 ± .06 mm
Tensile Properties[3]	D-882 Min				
Strength at Break		48 lbs/in 8.4 kN/m	73 lbs/in 12.8 kN/m	97 lbs/in 17.0 kN/m	116 lbs/in 20.3 kN/m
Elongation		360%	380%	430%	430%
Modulus at 100%		21 lbs/in 3.7 kN/m	32 lbs/in 5.6 kN/m	40 lbs/in 7.0 kN/m	50 lbs/in 8.8 kN/m
Tear Strength	D-1004 Min	6 lbs 27 N	8 lbs 35 N	10 lbs 44 N	13 lbs 58 N
Dimensional Stability	D-1204 Max Chg	4%	3%	3%	3%
Low Temperature Impact	D-1790 Pass	-15° F -26° C	-20° F -29° C	-20° F -29° C	-20° F -29° C
Index Properties	**ASTM**	**PVC 20**	**PVC 30**	**PVC 40**	**PVC 50**
Specific Gravity	D-792 Typical	1.2 g/cc	1.2 g/cc	1.2 g/cc	1.2 g/cc
Water Extraction Percent Loss (max)	D-1239 Max Loss	0.15%	0.15%	0.20%	0.20%
Average Plasticizer Molecular Weight	D-2124	400	400	400	400
Volatile Loss	D-1203 Max Loss	0.9%	0.7%	0.5%	0.5%
Soil Burial	G160 Max Chg				
Break Strength		5%	5%	5%	5%
Elongation		20%	20%	20%	20%
Modulus at 100%		20%	20%	20%	20%
Hydrostatic Resistance	D-751 Min	68 psi 470 kPa	100 psi 690 kPa	120 psi 830 kPa	150 psi 1030 kPa
Seam Strengths	**ASTM**	**PVC 20**	**PVC 30**	**PVC 40**	**PVC 50**
Shear Strength[3]	D-882 Min	38.4 lbs/in 6.7 kN/m	58.4 lbs/in 10 kN/m	77.6 lbs/in 14 kN/m	96 lbs/in 17 kN/m
Peel Strength[3]	D-882 Min	12.5 lbs/in 2.2 kN/m	15 lbs/in 2.6 kN/m	15 lbs/in 2.6 kN/m	15 lbs/in 2.6 kN/m

Notes:
3. Metric values are converted from US values and are rounded to the available significant digits.

2.3 TESTING OF ROLL GOODS PRIOR TO FABRICATION

A. The fabricator of PVC panels used in this work shall take samples once per lot or every 40,000 pounds of roll goods received from the PVC manufacturer, whichever results in more tests.

B. Samples shall be tested by a qualified laboratory and must meet or exceed the following properties as specified in the table in Section 2.2.B of these specifications.
1. Thickness
2. Tensile Properties
3. Tear Resistance
4. Low Temperature Impact
5. Dimensional Stability

2.4 INSPECTION OF ROLL GOODS PRIOR TO FABRICATION

A. Prior to factory seaming, all roll goods shall be unwound and inspected on both sides for unmixed or poorly dispersed ingredients, the presence of contaminants or foreign particles, pin holes and any other defects.

B. All defects and impurities will be removed or repaired before the membrane is fabricated into panels.

C. Thickness shall be measured according to ASTM D882 at the center and each edge of the beginning and end of each roll of material used in this work.

D. A log shall be maintained showing the material type, roll number, lot number, and three thickness measurements at the beginning and end of each roll. This log shall be made available to the Owner or Engineer upon request.

2.5 FACTORY FABRICATION

A. Individual calendared widths of PVC shall be factory fabricated into large panels so as to minimize field seaming during installation.

B. Factory fabricated seams shall be accomplished by the use of chemical, dielectric or thermal bonding methods.

C. Seams shall have a minimum of one inch (1") nominal width.

D. Production records shall identify each factory pre-assembly panel by panel number, size, date of pre-assembly, material lot number and seam station identification. Mark each panel prominently with the panel number and panel size to coincide with production records.

2.6 INSPECTION AND TESTING OF FACTORY SEAMS

A. The fabricator shall perform 100% continuous visual inspection of each lineal foot of seam as it is produced.

1. Upon discovery of any defective seam, the fabricator shall stop production of panels used in this work and shall repair the seam and determine and rectify the cause of the defect prior to continuation of the seaming process.
2. As evidence that the fabricator has complied with the inspection requirement of this Section, a mark which identifies the inspector by name or number shall be hand stamped with indelible ink no less frequently than five feet on center along each factory seam.

B. A 48 inch sample shall be taken from each factory seam welding unit used in this work at the beginning of each work shift and every four hours of production thereafter.
1. Samples shall be non destructive, i.e., will not require patching of fabricated panels.
2. Test specimens shall be cut at quarter points from each 48 inch seam sample (a total of three places) and tested for seam strength requirements as specified in the table in Section 2.2.B of these specifications.
3. A log shall be maintained showing the date, time, panel number and test results. This log shall be made available to the Owner or Engineer upon request.

2.7 CERTIFICATION AND TEST REPORTS

A. Prior to installation of the PVC panels, the fabricator shall provide the Engineer with the following certification and test reports:
1. Written certification that the material meets all of the requirements of Section 2.1 and 2.2 of these specifications.
2. Written test results for the testing required by Section 2.3 of these specifications.
3. Written certification that inspection and thickness measurements have been performed according to Section 2.4. The Engineer may, at his discretion, require that a copy of the log specified in Section 2.4 be submitted for review.
4. Written certification that the factory seams were inspected and tested in accordance with Section 2.6. The Engineer may, at his discretion, require that a copy of the log specified in Section 2.6 be submitted for review.

2.8 CONFORMANCE TESTING

A. The Engineer, with assistance from the Contractor, will sample PVC materials which have arrived on-site for conformance testing.

B. The Contractor will be responsible for forwarding conformance samples to a certified, third party, testing laboratory for required testing.

C. Conformance samples will be taken a minimum of each lot, or every 100,000 square feet of material, whichever results in more tests.

D. PVC samples will be tested to ensure conformance with the specifications listed within this section. The conformance samples shall be tested for:
1. Thickness
2. Tensile Properties
   a. Strength at break
   b. Elongation
   c. Modulus at 100%
3. Tear Strength
4. Seam strengths
   a. Shear Strength

b. Peel Strength

E. No PVC material shall be installed until conformance testing is complete on that material and, results show that the delivered material meets the requirements of the specifications.

F. Material which fails to meet the requirements of the conformance testing shall be rejected and not utilized within the project.

G. Rejected material will be replaced with material meeting the specifications at no additional cost to the Owner.

H. The Contractor shall pay for all costs associated with this conformance testing and retesting of new material, if necessary. The Contractor shall account for the time associated with this testing in his schedule. No additional contract time will be granted for this item.

2.9 COVER MATERIAL

A. The liner cover material shall consist of soil free of sharp, jagged rock, roots, frozen material, debris or any other material which may be abrasive to or may puncture the membrane. Any rocks contained in the soil that are larger than 1/2" nominal in any direction must be removed.

PART 3 - EXECUTION

3.1 GENERAL

A. All installations shall be as per the manufacturer's recommended procedures.

B. The Contractor is responsible for horizontal and vertical control.

3.2 SUBGRADE PREPARATION

A. The surface of the subgrade shall be prepared by excavating the ponds to the elevations and sections indicated in the drawings.

B. The liner subgrade shall be prepared as outlined in Section 02320 Earthwork.

C. The subgrade shall be uniformly compacted to 95% of standard proctor maximum density to ensure against settlement and shall be steel wheel rolled prior to liner installation

D. Surfaces to be lined will be smooth and free of all rocks and stones greater than 1/2" diameter, sticks, sharp objects, or debris of any kind. The surface should provide a smooth, flat, firm, unyielding foundation for the geomembrane with no sudden, sharp, or abrupt changes or break in grade.

E. The geomembrane installer shall inspect the subgrade surface to be covered with geomembrane on each day's operation prior to placing the geomembrane to verify suitability.

F. The Geomembrane installer shall provide daily written acceptance for the subgrade surface to be covered in that day's operation. The surface shall be maintained in a manner to ensure subgrade suitability.

G. All subgrade damaged by construction equipment and deemed unsuitable for geomembrane deployment shall be repaired prior to placement of the geomembrane. All repairs shall be approved by the Engineer. The Contractor shall be responsible for preparation, repairs, and maintenance of the subgrade.

3.3 GEOMEMBRANE PLACEMENT

A. PVC geomembrane shall not be deployed until all applicable submittals, certifications, conformance testing and quality control certificates required in this specification are submitted and approved by the Engineer. Should the PVC geomembrane be deployed prior to approval of the Engineer, it will be at the sole risk of the geomembrane installer and/or contractor. If the material does not meet the specification it shall be removed from the site at no cost to the owner.

B. The PVC geomembrane shall be installed to the project limits as detailed on the panel layout drawings.

C. Temperature limitations shall be determined in the preconstruction meeting and approved by the Engineer. Liner temperature less than 60 degrees Fahrenheit is considered cold weather installation and Liner temperature greater than 105 degrees Fahrenheit is considered high temperature installation.
1. Under no circumstance shall the geomembrane be deployed or seamed at ambient air temperatures less than 40 degrees Fahrenheit, unless otherwise approved by Engineer.

D. No vehicles are allowed on the geomembrane. Typical equipment that is usually used during installation and testing and allowed on the geomembrane include air compressors, generators, etc.

E. Sandbags or equivalent ballast shall be used as necessary to temporarily hold the PVC geomembrane in position.

F. Geomembrane placement shall not be performed if moisture present prevents proper subgrade preparation, panel placement, or panel seaming.

G. Damaged panels or portions of damaged panels which have been rejected shall be marked and their removal from the work area recorded.

H. The geomembrane shall not be allowed to "bridgeover" voids or low areas in the subgrade. In these areas the PVC geomembrane shall be installed with sufficient slack as to allow material to remain in intimate contact with the subgrade or the subgrade repaired.

I. In general, seams shall be oriented parallel to the line of the maximum slope, i.e., the seam should run down the slope. In corners and odd geometric locations, the total length of the field seam shall be minimized. If at all possible, seams shall not be located at low points in the subgrade unless geometry requires seaming to be done at these locations.

J. Panel Overlapping for Seaming:

Chemical Seam - 6-8" overlap with a 2" wide seam.
Thermal Seams:
Single Track weld - 4 to 6" overlap and a minimum 1.5" wide seam.
Dual Track weld - 4 to 6" overlap and minimum 0.5" wide seams

3.4 SEAMING PROCEDURES

A. Cold weather seaming procedures may include the following.
1. Storage of fabricated product in a heated space prior to deployment.
2. Applying preheat immediately in front of area to be welded.
3. QA/QC testing requirements for test welds to determine if field seams can be created to specification requirements will be increased as required by Engineer.
4. The Engineer shall approve the cold weather procedures and be available to verify that seam quality parameters can be achieved.

B. High temperature seaming procedures may include the following:
1. Suspension of work if temperatures create a dangerous work environment for the installation crew and inspectors.
2. Preparation of additional qualification strips, as required by Engineer, to determine if welding can be completed and made to meet specification seam strength requirements.

C. Fishmouths shall be kept to a minimum and when necessary be cut out and repaired so as to create a flat overlap.

D. All repairs shall extend a minimum of 6" past any cut in all directions. Thus, a circular patch will have a diameter of at twelve inches, i.e., a radius of six inches, for a small hole.

3.5 SEAMING SPECIFICATIONS

A. Chemical Seaming
1. Prior to starting any field welds each seam crew shall prepare a test seam to verify quality and temperature requirements can be met. Test seams must pass project specifications in order to approve the seaming crew to weld on that particular day.
2. Panels to be welded using chemicals shall be overlapped a minimum of 6".
3. Care should be taken to clean all areas with a rag prior to applying chemicals.
4. A sufficient amount of chemical shall be placed on both sheets of the PVC geomembrane to be joined with either a squeeze bottle or paintbrush and form a continuous wide weld path of at least 1.5 inches in width.
5. After application of chemical, the seam area should be rolled with a seam roller releasing any air bubbles and forming a continuous seam path. The seaming crew shall take care to always tie-in or weld to the prior chemical seam area as they continue along down the seam.
6. Upon completion of each seam, the seam shall be inspected and any loose areas re-rolled and/or chemical added as required to complete the seam.
7. Destructive seam samples shall be pulled at intervals as directed by the Engineer or at a minimum of one per 500 lineal feet of chemically sealed seam.
a. Samples shall be tested and evaluated in accordance with the table in Section 2.2.B of these specifications.

B. Thermal Welding Specifications

1. Each Master Seamer shall complete a trial weld of 5' long and each sample shall be tested in accordance with the these specifications. Test seams must pass project specifications in order to approve the seaming crew to weld on that particular day.
2. Panels to be seamed together by a thermal weld shall be overlapped 4" to 6".
3. Panels shall be wiped clean removing dirt and dust prior to seaming. This can be facilitated with the use of hot air welders that blow dirt and dust from the seam area.
4. Panels should be positioned and all wrinkles pulled out of the seam area prior to seaming.
5. Master Seamer shall walk with welder at all times and continually check overlap, temperature, and weld quality.
6. Destructive seam samples shall be pulled at intervals as directed by the Engineer or at a minimum of one per 500 lineal feet of thermally welded seam when Air Lance Testing using ASTM D4437 is performed. When Air Channel Testing is performed on the thermally welded seam in accordance with ASTM D7177, no destructive samples will be taken from the production liner. However, destructive samples will be obtained from test welds and/or welds in the anchor trench at the beginning and end of each day.
    a. Both sides of the weld shall be tested for shear and peel strength sample in accordance with ASTM D6392.
    b. Samples shall be tested and evaluated in accordance with the table in Section 2.2.B of these specifications.

3.6 PIPES AND STRUCTURE PENETRATION SEALING SYSTEM

A. Provide penetration sealing system as shown on the Project Drawings or required by the Fabricator.

B. Penetrations shall be sealed using the same PVC geomembrane material, flat stock, prefabricated boots, and accessories as shown on the project drawings. The prefabricated or field fabricated assembly shall be field welded to the main PVC geomembrane as shown on the project drawing so as to prevent leakage.

C. All sealed areas shall be Air Lance tested using ASTM D4437 and verified to be leak free.

3.7 FIELD QUALITY CONTROL

A. The Engineer shall be notified prior to all pre-qualification and production welding and testing.

B. Prequalification Test Seams
1. Test seams shall be prepared and tested by the Geomembrane Installer to verify that the seaming parameters are adequate and meet these specifications.
2. Test seams shall be made in accordance with ASTM D 4437 by each welding technician at the beginning of each seaming period. Test seaming shall be conducted under the same conditions and with the same equipment and operator as production seaming. The test seams shall be approximately 5' long for all types of field welds.
3. Samples shall be tested and evaluated in accordance with the table in Section 2.2.B of these specifications.

4. If there is no area on site to provide for these requirements, seam strength can be verified for production using trial welds sent to an independent lab to verify quality.
5. For peel and shear testing see Destructive Field Seam Testing Section 3.07(D) of this document. Field peel and shear strength values should meet the requirements of the table in Section 2.2.B of these specifications
6. If a test seam fails, an additional test seam shall be immediately completed. If the additional test seam fails, the seaming apparatus shall be rejected and not used until the deficiencies are corrected and a successful full test seam can be produced.
7. Each test seam shall be labeled with date, geomembrane temperature, number of seaming unit, panel identification, seam number or test location, technician performing the test seam and a pass or fail description.

C. Non-Destructive Field Seam Testing
1. All field seams shall be non-destructively tested by the Geomembrane Installer over the full length of the seams before the seams are covered. Each seam shall be numbered or otherwise designated. The location, date, test unit, name of QC person, and outcome of all non-destructive shall be recorded and submitted to the Engineer.
2. Testing should be performed as the seaming progresses, not at the completion of all field seaming, unless agreed to in advance by the Engineer. All defects found should be repaired, re-tested and remarked to indicate acceptable completion of repair.
3. Non-destructive testing shall be performed using either the air lance test method (ASTM D4437) or air-channel pressure test method (ASTM D7177).
4. Air Lance Testing
   a. Chemical and solid thermal, i.e., single track, welds shall be tested utilizing the Air Lance Test Method ASTM D 4437. The Geomembrane Installer shall provide an air compressor, air hose, and air lance wand with a pressure gauge capable of measuring the air flow at the tip. The testing shall be performed by experienced technicians familiar with this testing procedure.
   b. This non-destructive test involves placing the air lance wand 1/4" to 1/2", but not more than 2", from the edge of the completed seam and closely monitoring the backside of the sheet for any air penetration through the seam, loose edges, riffles, and/or noise . If air penetrates the seam area, the technician will either see this visibly or hear it audibly.
   c. All seams tested by the air lance method shall be marked with the date tested, name of the technician, length of the seam, and test results. As with all QC work this should be documented on all QC paperwork and witnessed by the Engineer.
5. Air Channel Testing
   a. Dual track thermal seams with an enclosed air channel shall be pressure tested by the Geomembrane Installer in accordance with ASTM D7177.
   b. Equipment for testing dual track thermal seams shall be comprised of but not limited to: an air pump equipped with a pressure gauge capable of generating and sustaining a pressure of 420 kPa (60 psi), mounted on a cushion to protect the geomembrane; and a manometer equipped with an approved pressure feed device.
   c. The testing activities shall be performed by the geomembrane installer. Both ends of the seam to be tested shall be sealed and an approved pressure feed device inserted into the channel created by the dual track

thermal weld. The air pump shall be adjusted to a pressure corresponding to the following table from ASTM D1777.

d. The remainder of the air-channel test procedure is described in ASTM D7177 and shall strictly adhered to.

Sheet Temperature °F	Air Pressure (psi)	Pressure Hold Time
40	60	30 seconds
45	56	30 seconds
50	52	30 seconds
55	47	30 seconds
60	42	30 seconds
65	40	30 seconds
70	36	30 seconds
75	34	30 seconds
80	29	30 seconds
85	27	30 seconds
90	25	30 seconds
95	24	30 seconds
100	22	30 seconds
105	20	30 seconds
110	19	30 seconds

e. If the air-channel test does not meet the specified pressure for that sheet temperature (see table above), the faulty area shall be located, repaired and retested by the geomembrane installer.

f. Results of the air pressure testing shall be marked on the seam tested and logged on the air pressure testing record.

6. Vacuum Box Testing

a. Vacuum Box testing is not allowed without prior approval of the Engineer. If approved, vacuum box must have a screen covering the box opening to help prevent geomembrane from pulling into the box . The vacuum box test procedure is described in ASTM D4437.

D. Destructive Field Seam Testing

1. When Air Lance Testing is performed using ASTM D4437, a minimum of one destructive sample per 500 lineal feet of field seam or at another pre-determined length should be obtained and tested in accordance with ASTM D6392 by the Geomembrane Installer from a location specified by the Engineer. To obtain test results prior to completion of geomembrane installation, destructive samples shall be cut by the geomembrane installer as directed by the Engineer as seaming progresses. The Geomembrane Installer shall not be informed in advance of the sample location. When Air Channel Testing is performed, no destructive samples will be taken from the production liner but destructive samples can be obtained from the anchor trench or test welds.

2. All field samples shall be marked with their sample number and seam number. The sample number, date, time, location, and seam number shall be recorded. The geomembrane installer shall repair all holes in the geomembrane resulting from obtaining the samples. All patches shall be

repaired and tested using an air lance test. All destructive seam areas shall be patched and tested the same day as the destructive sample.

3. The destructive sample size shall be 300 mm (12" wide by 1 m (36") long with the seam centered lengthwise. The sample shall be cut length-wise. The sample shall be cut into three equal sections and distributed as follows; one section given to the Engineer as an archive sample, one section given to the Contractor for laboratory testing as specified in paragraph five (5) of this section, i.e., 3.07(D)(5), and one section given to the geomembrane installer for field testing as specified in paragraph four (4) of this section, i.e., 3.07(D)(4).
4. For field testing of destructive samples, the geomembrane installer shall cut 10 identical 25mm (1 inch) wide replicate specimens from his sample. The geomembrane installer shall test five replicate specimens for seam shear strength and five for peel strength. Peel strength tests will be performed on both the inside and outside of dual track welds. To be acceptable an average of five specimens must pass requirements of the table in Section 2.2.B of these specifications.
5. Independent seam testing is required, it shall be conducted in accordance with ASTM D 6214 for chemical seams and ASTM D 6392 for thermal seams by an accredited laboratory. All costs associated with independent seam testing are the responsibility of the Contractor.
6. Reports of the results of examinations and testing shall be prepared and submitted to the Engineer.
7. For field seams, if laboratory tests fail, that shall be considered an indicator of possible inadequacy of the entire seam length corresponding to the test sample. Additional destructive samples of the subject seam shall be taken by the geomembrane installer at locations indicated by the Engineer, typically 3 meters (10 feet) on either side of the failed sample and laboratory seam tests shall be performed. Passing tests shall be an indicator of adequate seams. Failing tests shall be an indicator of inadequate seams. All destructive sample locations shall be repaired with a cap strip either thermally or chemically welded into place. All cap stripped seams shall be non-destructively tested with an air lance test.

E. Identification of Defects
1. Panels and seams shall be inspected by the geomembrane installer and the Engineer during and after panel deployment to identify all defects, including holes, blisters, and undispersed raw materials.
2. Seams shall be inspected by the geomembrane installer and the Engineer before, during, and after field seaming to identify all dirty and wrinkled areas and any defects.

F. Evaluation of defects: Each suspect location (both in geomembrane seam and non-seam areas) shall be non-destructively tested using the air lance test method in ASTM D4437. Each location which fails non-destructive testing shall be marked, numbered, measured, and posted on the daily installation drawings and subsequently repaired.
1. If a destructive sample fails the field or laboratory tests, the geomembrane installer shall repair the seam between the two nearest passed locations on both sides of the failed destructive sample location.
2. Defective seams, tears, or holes shall be repaired by re-seaming or applying a cap strip.
3. Re-seaming may consist of either:

a. Removing the defective area and rewelding the parent material using the original welding equipment, or
b. Re-seaming by cap stripping as described in section 3.07(D)(7).

4. Each patch shall extend a minimum of 150 mm (6 inches) in all directions beyond the defect.
5. All repairs shall be measured, located, and recorded.

G. Verification of repairs on seams: Each repair shall be non-destructively tested using the air lance test in ASTM D4437. Tests which pass the nondestructive test shall be taken as an indication of a successful repair. Failed tests shall be re-seamed and retested until a passing test result is obtained. The number date, location, technician, and test outcome of each patch shall be recorded.

H. Daily field installation reports: At the beginning of each day's work, the installer shall provide the engineer with daily reports for all work accomplished the previous work day. Reports shall include the following:
1. Total amount and location of geomembrane placed;
2. Total length and location of seams completed, technician name, and welding unit numbers;
3. Drawings of the previous day's installed geomembrane showing panel numbers, seam numbers, and locations of non-destructive and destructive testing;
4. Results of the pre-qualification test seams;
5. Results of non-destructive testing.
6. Results of destructive testing.
a. Destructive test results shall be reported prior to covering the lining or within 48 hours.

3.8 QUALITY OF WORKMANSHIP

A. All joints, on completion of the work, shall be tightly bonded. Any lining surface showing injury due to scuffing, penetration by foreign objects, or distress from rough subgrade, shall, as directed by the Engineer, be replaced or covered and sealed with an additional layer of PVC of the proper size.

3.9 ANCHOR TRENCH CONSTRUCTION AND BACKFILLING

A. Construct and line anchor trench as specified in the drawings.

B. The anchor trench should be backfilled and compacted by the Contractor as approved by the Engineer. Trench backfill material should be placed in loose lifts and compacted.

C. Care should be taken when backfilling the anchor trench to prevent any damage to the geomembrane or other geosynthetics. At no time will construction equipment come into direct contact with the geomembrane. If damage occurs, it will be repaired, at the Contractor's expense, prior to the completion and backfilling of the anchor trench.

3.10 DISPOSAL OF SCRAP MATERIALS

A. On completion of installation, the geomembrane installer shall dispose of all waste and scrap material in a location provided and approved by the Owner. The installer should also remove all equipment used in connection with the work herein, and shall leave the premises

in a neat acceptable manner. No scrap material shall be left on the completed surface of the PVC geomembrane.

3.11 COVERING THE GEOMEMBRANE

A. The PVC geomembrane must be covered with a minimum of 12 inches of clean soil, free of sticks, stones larger than 1/2 inch diameter, rubbish, or any other material which may damage the liner. The cover material should be placed over the liner as soon as practical after the liner is installed.

B. Care should be taken when covering the liner to prevent any damage to the geomembrane or other geosynthetics. At no time will construction equipment come into direct contact with the geomembrane. If damage occurs, it will be repaired, at the contractor's expense, prior to the completion of geomembrane covering.

C. Cover soil shall be only placed over the geomembrane from the base of the slope to the top of the slope. Cover soil should never be pushed down the slope.

D. Cover soil should be "rolled" onto the installed geomembrane and not pushed along the geomembrane which can result in damage and wrinkling of the geomembrane.

E. Low ground pressure (LGP) equipment shall be used to spread the earth cover over the geomembrane, unless otherwise approved by the Engineer. If the Contractor elects to use equipment that is not designated low ground pressure, the Contractor must satisfactorily demonstrated to the Engineer that such equipment does not damage the geomembrane. The equipment shall be routed over the material such that uniform compaction is attained.

3.12 LINER ACCEPTANCE

A. The PVC Geomembrane will be accepted by the Owner and Engineer when all of the following have been completed:
   1. The entire installation is finished or an agreed upon subsection of the installation is finished.
   2. All Installers QC documentation is completed and submitted to the owner.
   3. Verification of the adequacy of all field seams and repairs and associated geomembrane testing is complete.
   4. Leak Test meeting project requirements complete.

END OF SECTION 02666

SECTION 02708 - ALUMINUM BED EDGING

PART 1 - GENERAL

1.1 DESCRIPTION:

The work of this section consists of providing and installing edging for planting beds.

1.2 RELATED WORK DESCRIBED ELSEWHERE:

Trees, shrubs, and groundcovers - Section 02840

1.3 QUALITY ASSURANCE:

For actual installation of edging, use only personnel who are skilled in the work required, familiar with the manufacturer's recommended method of installation, and thoroughly familiar with the requirements of this work.

PART 2 - MATERIALS

2.1 MANUFACTURER:

All edging shall be 1/8" x 4" aluminum edging, mill finish, as manufactured by Permaloc, 4254 Ravine Rd., Kalamazoo, MI 49007, Telephone 616/345-6999.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS:

A. Inspection

Prior to all work of this section, carefully inspect installation work of other trades and verify that a such work is complete to the point that installation of edging may properly commence.

B. Discrepancies

In the event of discrepancy, immediately notify the Owner's Representative.

Do not proceed with installation in areas of discrepancy until all such discrepancies have been resolved.

Beginning of installation means acceptance of existing conditions by installer.

3.2 INSTALLATION:

Install all edging where indicated on the Plans, anchoring all edging firmly in place and maintaining smooth curves and straight lines in accordance with manufacturer's recommended installation procedures.

Place line stakes approximately 3.2' o.c., and plumb. Place splicer stakes in a manner so that smooth lines are maintained at all times. Kinked or waving edging, or edging not uniformly graded, shall be rejected, and replaced at no additional cost to the Owner.

END OF SECTION 02708

SECTION 02760 - IRRIGATION SYSTEM

PART 1 - GENERAL

1.1 DESCRIPTION:

The work of this section consists of all items necessary to install the irrigation system required as indicated on the plans and includes, but not necessarily limited to:

Lawn and Shrub Sprinkler System
Automatic Controller and Remote Control Valves

1.2 RELATED WORK DESCRIBED ELSEWHERE:

Irrigation System, Trenching and Backfilling	- Section 02225
Irrigation Central Control System	- Section 02810
Turf Seeded Lawns	- Section 02822
Electrical	- Division 16

1.3 QUALITY ASSURANCE:

A. Qualifications of Installer

Provide at least one person who shall be present at all times during execution of this portion of the work and who shall be thoroughly familiar with the type of materials being installed and material manufacturer's recommended methods of installation and who shall direct all work performed under this section.

B. Coordination of Work

All work of this section, and the installation of all lawns and all plant materials shall be performed by one Contractor.

C. Codes and Standards

In addition to complying with all pertinent codes and regulations, comply with the latest rules of the National Electrical Code for all electrical work and materials.

Where provisions of pertinent codes and standards conflict with the requirements of this section of these Specifications, the more stringent provisions shall govern.

1.4 SUBMITTALS:

A. Material List

Before any irrigation system materials are delivered to the job site, submit to the Owner's Representative a complete list of all irrigation system materials proposed to be furnished and installed.

Show manufacturer's name and catalog number for each item, furnish complete catalog cuts and technical data, and furnish the manufacturer's recommendations as to method of installation.

Do not permit any irrigation system component to be brought onto the job site until it has been approved by Owner's Representative.

1.5 PRODUCT HANDLING:

A. Protection

Use all means necessary to protect irrigation system materials before, during, and after installation and to protect the installed work and materials of all other trades.

B. Replacements

In the event of damage, immediately make all repairs and replacements necessary to the approval of the Owner's Representative and at no additional cost to the Owner.

1.6 TECHNICAL ASSISTANCE:

A. Responsibility

Contractor shall provide all manufacturer and other technical assistance as required for installation and adjustment of the complete irrigation system as specified.

PART 2 - MATERIALS

2.1 PIPE:

A. Plastic Pipe

Plastic pipe shall be rigid unplasticized PVC-200 as indicated on the plans, conforming to ASTM D-1784 and D-2241 standard specifications for PVC plastic pipe. The pipe shall be homogeneous throughout and free from visible cracks, holes, foreign materials, blisters, deleterions, wrinkles, and dents.

All pipe shall be continuously and permanently marked with the following information.

Manufacturer's name or trademark, size, schedule and type of pipe, working pressure at 73 degrees F. and National Sanitation Foundation (N.S.F.) approval.

All mainlines shall be installed with gasketed pipe. All laterals shall be installed with solvent weld pipe joints.

2.2 RISERS:

A. Stationary Spray Heads

All stationary spray heads shall have Hunter model SJ-512 pre-manufactured swing assemblies or equal approved in advance by the Owner's Representative. Swing assembly shall be 1/2"x 1/2"x 12" NPT.

B. Rotor Pop-up Sprinklers

All 1" inlet rotor pop-up sprinklers shall have an adjustable pre-assembled double swing joint riser. Swing joints shall be Rain Bird model TSJ-12 or equal approved in advance by the Owner's Representative. Swing joints shall be 1" x 12" and shall be threaded both ends.

All 3/4" inlet rotor pop-up sprinklers shall have an adjustable pre-assembled swing assembly risers. Swing assemblies shall be Rain Bird model TSJ-12075 or equal approved in advance by the Owner's Representative. Swing assemblies shall be 3/4" x 12" and shall be threaded both ends.

C. Quick Coupling Valves

All quick coupling valves shall have an adjustable pre-assembled double swing joint riser. Swing joints shall be Lasco model G13S-218 or equal approved in advance by the Owner's Representative. Swing joints shall be 1" x 18" and shall be threaded both ends. The swing joint riser shall be of proper pipe size to match quick coupling valve threads.

2.3 MANUAL VALVES:

A. Gate Valves

All manual gate valves shall be 200 PSI rated.

All manual gate valves, sizes 2-1/2 inch and smaller, shall be all bronze double disc wedge type with integral taper seats and with non-rising stem, 200 WOG and shall be Nibco T-113 Series or equal accepted in advance by the Owner's Representative.

All manual gate valves of 3 inch size or larger shall be iron body, brass trimmed, double disc wedge type with integral taper seats and with non-rising stems, and shall be Matco 10 RT Series or equal accepted in advance by the Owner's Representative.

2.4 VALVE BOXES:

A. General

All remote control valves, manual control valves, zone shut-off valves, gate valves or globe valves, quick coupling valves, grounding rods, air relief valves, and 120 volt and communication wiring splices, unless otherwise indicated, shall be installed in valve access box of proper size as required for easy access to the valve. All covers to be T-Cover type and locking. All valve boxes shall be of the same manufacturer. Locking bolts shall be delivered to the Owner unless directed otherwise by the Owner's Representative.

B. Grounding Rods

Standard box for all ground rod installations to be Carson 910-10-4 or NDS 212BCB ELEC, with gray cover.

C. Lateral, Isolation, Quick Coupling, and Drain Valves

Standard box for all lateral, isolation, quick coupling, and drain valves to be Carson 910-10-4 or NDS 212BCB with locking green cover. Provide 4" PVC pipe sleeve valve box extensions as required.

All boxes for valves 3" and larger shall be Carson 1419-12-4 or NDS 214BCB with locking green cover.

D. Control Valves

Standard box for all electric control valves, flow sensors, and blowout devices shall be Carson 1419-12-4 or NDS 214BCB with locking green cover. Provide matching valve box extensions as required. Maximum of 2 control valves per box.

E. Air Relief Valves

Standard box for air relief valves shall be Carson 1220-12-4 or NDS 218BCB with locking green cover. Provide matching valve box extensions as required.

F. Pull Boxes

Standard box for all electrical and communication cable pull boxes shall be Carson 1419-12-4 or NDS 214BCB ELEC with locking gray cover, electrical marking. Provide matching valve box extensions as required.

2.5 SPRINKLER HEADS:

A. General

Sprinkler heads shall be of the types and sizes as indicated on the plans. They shall be constructed of bronze, brass, stainless steel, cast iron and/or non-metallic materials.

All heads of a particular type and for a particular function in the system shall be of the same manufacture and shall be marked with the manufacturer's name and identification, in such a position that they can be identified without being removed from the system.

2.6 AUTOMATIC IRRIGATION CONTROLLERS:

Field controllers shall be model numbers and manufacturers as shown on the plans, or acceptable equal.

Field controllers shall be installed on approved concrete bases in accordance with the manufacturer's recommendations as shown on the Drawings.

Field controllers shall be installed with manufacturer's lightning and surge protection.

2.7 AUTOMATIC REMOTE CONTROL VALVES:

All remote control valves shall be of the same manufacturer as the selected automatic irrigation controller and shall be globe or angle pattern in type and model numbers as indicated on the plans. All valves shall be 24-volt, with epoxy-sealed solenoid coils and throttling stem.

2.8 CONTROL CABLE:

All electrical control and ground wire shall be irrigation control cable as manufactured by Paige Electric Co., Box 368, Union, NJ 07083, telephone 800-327-2443 or equal approved in advance by the Owner's Representative. All control cable shall be 14-gauge and all common cable shall be 12-gauge unless otherwise indicated on the drawings, and rated for direct burial applications.

All wiring to be used for connecting the automatic remote control valve to the automatic controllers shall be 600 volt, soft drawn solid copper single conductor wire meeting the requirements of ASTM B-3 or B-8, -55° C to +60° C temperature rated with 0.045" polyethylene insulation. All control cable shall be marked with manufacturer identification, voltage rating, size and type and shall bear UL file number.

All cables shall be tested physically and electrically in accordance with UL Standard 493, and 83, paragraphs 28.1, 29.1 and 29.2. All reels and cartons shall bear UL labels.

All control or "hot" wires shall be of one color (black) and all common or "ground" wires shall be of another color (white). When more than one valve is operated by a single controller station provide separate control wire from the controller to each valve. All control cable shall run continuously from the controller to the valve without splicing.

Connection to remote control valve solenoid shall be made with 3M DBY/DBR Splice kits and located in valve the box.

Verification of wire types and installation procedures shall be checked to conform to local codes.

2.9 120 VOLT WIRING:

Refer to Division 16.

2.10 GROUNDING:

A. General

All controllers shall be properly grounded in accordance with manufacturer's installation requirements.

B. Materials

All ground rods shall be 5/8" x 8' copper. Ground wires shall be #6 bare copper wire, solid strand. Ground wires shall be attached to ground rods with cadweld connectors. All ground rods shall be housed in valve box as specified.

2.11 FITTINGS:

A. General

All plastic pipe fittings shall be permanently marked with the following information:

Manufacturer's name or trademark, size, schedule and type of pipe, working pressure at 73 degrees F. and National Sanitation Foundation (N.S.F.) approval.

All plastic pipe fittings to be installed shall be molded fittings manufactured of the same material as the pipe and shall be suitable for solvent weld, slip joint ring-tite seal, or screwed connections. Marlex fittings shall not be permitted.

Slip fitting socket taper shall be so sized that a dry unsoftened pipe end, conforming to these special provisions, can be inserted no more than halfway into the socket. Plastic flange fittings will not be permitted. Only schedule 80 fittings may be threaded.

When connection is plastic to metal, plastic male adaptors shall be used. The male adaptor shall be hand tightened, plus one turn with a strap wrench. Joint compound shall be Teflon Tape.

B. Fittings- Solvent Weld

All lateral line fittings shall be schedule 40 solvent weld fittings.

Fittings shall be manufactured by Lasco, Spears or acceptable equal.

C. Fittings- Gasketed

All mainline fittings shall be gasketed ductile iron.

Fittings shall be manufactured by Harco or acceptable equal.

D. Fittings- Mainline to Lateral

Connection between mainline and lateral control valve shall be made using a gasketed ductile iron service tee and ductile iron lateral 90 swivel.

Fittings shall be manufactured by Harco or acceptable equal.

E. Fittings- Saddle Tees

Shall not be permitted.

2.12 SOLVENT CEMENT

All solvent cement and primer shall be manufactured by the same manufacturer for use together. Cement and primer products shall be manufactured with all virgin materials only. Solvent cement shall be NSF listed and shall meet or exceed ASTM D-2564. Primer shall be NSF listed and shall meet or exceed ASTM F-656.

2.13 CONCRETE:

All concrete shall be 3,000 psi at 28 days, transit mixed. Provide certifications with each delivery.

2.14 OTHER MATERIALS:

A. Materials to be furnished

Supply as part of this contract the following tools:

Two keys for each automatic controller.
Four quick coupler valve keys and matching hose swivel.
Two isolation valve keys for each type of valve installed.
Five heads of each type installed with nozzles.
One automatic control valve for each size and type installed.

The above equipment shall be turned over to the Owner at the conclusion of the project. Before final inspection can occur, evidence that the Owner has received materials must be shown to the Owner's Representative.

All other materials, not specifically described but required for a complete and proper irrigation system installation, shall be new, first quality of their respective kinds, and subject to the approval of the Owner's Representative.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS:

A. Inspection

Prior to all work of this section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.

Verify that irrigation system may be installed in strict accordance with all pertinent codes and regulations, the original design, the referenced standards, and the manufacturer's recommendations.

B. Discrepancies

In the event of discrepancy, immediately notify the Owner's Representative.

Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

Beginning of installation means acceptance of existing conditions by installer.

3.2 FIELD MEASUREMENTS:

Make all necessary measurements in the field to ensure precise fit of items in accordance with the original design.

3.3 TRENCHING AND BACKFILLING:

A. General

Perform all trenching and backfilling as specified by Section 02225 of this Specification.

3.4 INSTALLATION OF PIPING:

A. General

Layout the piping system in strict accordance with the plans.

Where piping is shown on the plans to be under paved areas but running parallel and adjacent to planted areas, the intention is to install the piping in the planted areas.

B. Pipe Depth

All mainlines shall be installed with 18" minimum cover over the pipe. All laterals shall be installed with 12" minimum cover over the pipe.

C. Line Clearance

All lines shall have a minimum clearance of 4 inches from each other, and 6 inches from lines of other trades, except through pipe sleeves.

Parallel lines shall not be installed directly over one another.

D. Inspection of Pipe and Fittings

Carefully inspect all pipe and fittings before installation, removing all dirt, scale, and burrs and reaming as required; install all pipe with all markings up for visual inspection and verification.

E. Plastic Pipe

Plastic pipe shall be installed in a manner so as to provide for expansion and contraction as recommended by the manufacturer.

All plastic joints shall be solvent-weld joints or slip seal joints. Only the solvent cement recommended by the pipe manufacturer shall be used. All plastic pipe and fittings shall be installed as outlined and instructed by the pipe manufacturer and it shall be the Contractor's responsibility to make arrangements with the pipe manufacturer for any field assistance that may be necessary. The Contractor shall assume full responsibility for the correct installation.

Slip seal gasketed joints may be used on all pipe 3" and larger.

All plastic to metal joints shall be made with plastic male adaptors.

The solvent-weld joints shall be made dry.

The solvent-weld joints shall be allowed to set at least 24 hours before pressure is applied to the system on PVC pipe.

F. Thrust Blocks

Provide concrete thrust blocks for all pipe as required by the schedule on the drawings.

All thrust blocks shall bear directly on undisturbed earth. Center pipe in the middle of thrust block.

3.5 INSTALLATION OF EQUIPMENT:

A. General

All fittings, valves, etc. shall be carefully placed in the trenches as shown on the plans.

All control wires shall be clearly labeled, by station using weatherproof material, both at the controller and at the valve. The inside cover of all automatic valve boxes shall also have the station number clearly painted in white.

All sprinklers, having adjustable nozzles, shall be adjusted for proper and adequate distribution of the water over the coverage pattern of the sprinkler.

All nozzles on stationary pop-up sprinklers or stationary spray heads shall be tightened after installation. All sprinklers having an adjusting screw, adjusting stem or adjusting friction collars shall be adjusted as required for the proper arc of coverage, radius, diameter and/or gallonage discharge.

B. Lawn Sprinkler Heads

Install lawn sprinkler heads where indicated on the plans and in strict accordance with the manufacturer's recommendations.

Along walks and driveways where finished grade is established, set all heads 1/4" below surface of pavement at time of installation and 1-1/2" from pavement. Stake all temporary risers.

Set all heads to final grade where sod lawn will be installed.

Upon completion of maintenance period, reset all lawn sprinkler heads flush with grade and firmly anchor with soil.

3.6 TESTING AND INSPECTION:

A. Closing-in Uninspected Work

Do not allow or cause any of the work in this section to be covered up or enclosed until it has been inspected, tested, and approved by the Owner's Representative.

Where trenches are not closed at the end of the day Contractor shall accept all liability for any damage or injury that may result from open trenches. Provide barricades and warning tape as necessary around all open trenches.

B. Flushing

Before backfilling the mainline, and with all control valves in place, but before lateral pipes are connected, completely flush and test the mainline and repair for all leaks; flush out each section of lateral pipe before sprinkler heads are attached.

C. Testing

Make all necessary provisions for thoroughly bleeding the line of air and debris.

Before testing, fill the line with water for a period of at least 24 hours.

After valves have been installed, test all live water lines for leaks at a pressure of 120 psi for a period of two hours, with all couplings exposed and with all pipe sections centerloaded.

Furnish all necessary testing equipment and personnel.

Correct all leaks and retest until acceptance by the Owner's Representative.

All couplings/joints shall remain exposed until mainline pressure test has been approved by the Owner's Representative.

D. Final Inspection

Thoroughly clean, adjust, and balance all systems.

Demonstrate the entire system to the Owner's Representative, proving that all remote control valves are properly balanced, that all heads are properly adjusted for radius and arc of coverage, and that the installed system is workable, clean, and efficient.

3.7 INSTRUCTIONS:

A. Record Drawings

Record accurately on one set of black and white prints of the site plan all installed work including both pressure and non-pressure lines.

Upon completion of each increment of work, transfer all such information and dimensions to the print. The dimensions shall be recorded in a legible and workmanlike manner. Maintain as-built drawings on site at all times.

All payment requests shall be accompanied by interim record drawings showing all work completed to that date. No payment request will be processed without an acceptable interim record drawing. Finished record drawings must be received and approved by the Owner's Representative before final payment will be approved.

Make all notes on drawing in pencil (no ball point pen). When the work has been completed, transfer all information from the field record print to a set of reproducible drawings.

Dimension from two permanent points of reference (buildings, monuments, sidewalks, curbs, pavement, etc.). Locations shown on as-built drawings shall be kept day to day as the project is being installed. All dimensions noted on drawings shall be 1/8-inch in size (minimum).

Show locations and depths of the following items:

Point of connection
Routing of sprinkler pressure lines (dimension maximum 200 feet along routing and at all changes in direction)
Gate valves
Sprinkler control valves
Quick coupling valves
Routing of control and power wires

Sprinkler heads
Other related equipment

B. Controller Charts

As-built drawings must be approved by Owner's Representative before charts are prepared.

Provide one controller chart for each controller supplied showing the area covered by automatic controller, of the maximum size controller door will allow.

The chart is to be a reduced drawing of the actual as-built system. Chart shall be a photo positive with different colored shading used to show area of coverage for each station. When completed and approved, the chart shall be hermetically sealed between two pieces of plastic. The chart shall be mounted in the controller using Velcro or equal type of semi-permanent fastening device.

All controller charts must be completed and approved prior to final payment.

C. Operation and Maintenance Manuals

Coordinate with requirements of Section 01705 to provide the following:

Prepare and deliver to the Owner's Representative within ten calendar days prior to completion of construction, all required and necessary descriptive material in complete detail and sufficient quantity, properly prepared in four individually bound copies of the operations and maintenance manual. The manual shall describe the material installed and shall be in sufficient detail to permit operating personnel to understand, operate and maintain all equipment. Spare parts lists and related manufacturer information shall be included for each equipment item installed. Each complete, bound manual shall include the following information.

Index sheet stating Contractor's address and telephone number, duration of guarantee period, list of equipment with names and addresses of local manufacturer representatives.

Complete operating and maintenance instructions on all major equipment.

In addition to the above maintenance manuals, provide the maintenance personnel with instructions for system operation and show written evidence to the Owner at the conclusion of the project that this service has been rendered.

3.8 MAINTENANCE:

A. System Operation

During and following installation of the irrigation system, the Contractor shall operate the irrigation system as required to maintain healthy turf. The Contractor shall continue to operate the irrigation system until the project is substantially complete and all construction Punch List items are satisfactorily complete as determined by the Owner's Representative.

3.9 GUARANTEE PERIOD:

A. Guarantee

The entire irrigation and water system shall be guaranteed to give satisfactory service for a period of one year from date of acceptance by the Owner.

Should any trouble develop within the time specified above due to inferior or faulty materials or workmanship, the trouble shall be corrected at no expense to the Owner.

Any and all damages resulting from faulty materials or workmanship shall be repaired by the Contractor to the satisfaction of the Owner, at no cost to the Owner.

B. Guarantee Period Services

The Contractor shall winterize the system and perform spring start-up of the system during the guarantee period. These functions shall be coordinated in advance with the Owner, and the Owner's personnel shall be encouraged to participate.

Upon re-energizing the system, the Contractor shall repair any leaks or breaks and shall check each head and valve, making any adjustment necessary.

END OF SECTION 02760

SECTION 02810 - IRRIGATION CENTRAL CONTROL SYSTEM

PART 1 - GENERAL

1.1 DESCRIPTION:

The work of this section consists of all items necessary to expand the Owner's existing Central Irrigation Control System (CICS) as indicated on the plans and includes but is not limited to:

- Central Computer Communication Unit
- ET Software
- Satellite Controllers
- Sensors

1.2 RELATED WORK DESCRIBED ELSEWHERE:

Irrigation System Trenching and Backfill	- Section 02225
Irrigation System	- Section 02760
Electrical	- Division 16

1.3 GENERAL CONDITIONS

A. Complete Operational Installation Required

All bids shall reflect a total complete and operational turn-key installation for each site and the entire system as shown on the plans. This shall include but not be limited to all equipment necessary to install new satellite controllers, including all necessary wiring and conduits, radio and hardwire communications equipment, and all incidentals needed for a complete functional installation consistent with the design intent.

Each bid shall include all equipment and labor necessary to provide a turn-key installation, including programming of Owner's central control computer. Contractor shall secure all technical support from the equipment manufacturers to assure complete and proper installation conforming to Manufacturer's recommendations and this specification.

The Contractor shall provide and pay for all materials, equipment, tools and labor required for the completion of this project. All utilities, transportation, and other facilities necessary for the execution and completion of the contract are also the responsibility of the Contractor.

B. Removal of Existing Equipment

All existing control equipment designated to be removed, or required to be removed to facilitate new installation, shall be delivered to the Owner as directed by the Owner's Representative.

1.4 CONTRACTOR'S USE OF PREMISES

Contractor shall not unreasonably encumber site with materials and equipment.

Contractor shall assume full responsibility for protection and safekeeping of materials and equipment stored on-site.

Contractor shall confine operations to areas indicated on the plans.

There shall be no interference with regular activities performed by the Owner.

1.5 ORDINANCES, REGULATIONS, CODES, PERMITS & INSPECTIONS

A. Contractor's Responsibility

Contractor shall follow all regulations, ordinances and codes governing the type of work he is doing on the job site. Any permits that are needed for the installation of construction of any work included under this contract, which are required by the authorities of jurisdiction, shall be obtained and paid for by the Contractor following whatever ordinances, regulations and codes requiring the permits.

If the authorities of the jurisdiction require inspection at said points of the installation, the Contractor shall arrange for, and be present at, any such inspections.

Any additional work or furnishing of materials required due to inspection by the authorities of jurisdiction shall be furnished at no cost to the Owner.

B. Conflict Resolution

In the event that the specifications for this project and existing ordinances, regulations or codes are in conflict, the more stringent provisions shall govern.

1.6 QUALITY ASSURANCE:

A. Contractor's Qualification

Contractor shall be a firm specializing in irrigation work with a minimum of 5 years experience. **All work of this section shall be performed directly under the supervision of trained personnel only.**

B. Qualifications of Installers

All installers working under the Contractor's Superintendent shall be thoroughly familiar with the type of materials being installed and material manufacturer's recommended methods of installation.

1.7 SUBMITTALS:

A. Material List

Before any CICS materials are delivered to the job site, submit to the Owner's Representative a complete list of all CICS materials proposed to be furnished and installed. Make submittals as specified by Section 01340 of this specification.

Show manufacturer's name and catalog number for each item, furnish complete catalog cuts and technical data, and furnish the manufacturer's recommendations as to method of installation.

Do not permit any CICS component to be brought onto the job site until it has been approved by the Owner's Representative.

B. Radio Survey:

Submit results of radio survey to Owner's Representative prior to ordering control system.

1.8 PRODUCT HANDLING:

A. Protection

Use all means necessary to protect all materials before, during, and after installation and to protect the installed work and materials of all other trades.

B. Replacements

In the event of damage, immediately make all repairs and replacements necessary to the approval of the Owner's Representative and at no additional cost to the Owner.

1.9 WARRANTY

A. Warranty

All equipment installed shall be warranted for a period of one (1) year from date of substantial completion.

All equipment shall have a manufacturer's guarantee against faulty design, improper assembly, defective workmanship or defective materials for a period of five (5) years from substantial completion.

PART 2 - MATERIALS

2.1 GENERAL:

A. General

All materials and equipment shall be installed in a neat and workmanlike manner following the recommendations of the manufacturers of the materials and industry standards.

All materials used shall be new and without flaws or defects of any type, and shall be the best of their class and kind.

2.2 CENTRAL CONTROLLER

A. General

The Owner's existing central controller is Hunter IMMS 2.4 system.

2.3 CENTRAL COMPUTER COMMUNICATIONS UNIT (CCC)

A. General

The irrigation control software shall have the ability to operate a local hardwired site through direct hardwire connection via the Central Computer Communications unit (CCC), which shall connect to the computer via a standard USB port within a distance of 6 ft. The CCC shall include its own UL-listed, CE-approved external transformer power supply and shall feature diagnostic power, transmit, and receive indicator lights.

B. Central Computer Communications Unit

The Central Computer Communications unit shall be Model IMMS-CCC as manufactured by Hunter Industries Incorporated, San Marcos, California. The existing ICCS currently operates a CCC via serial port communications. A second CCC is to be installed.

2.4 FIELD SATELLITE CONTROLLERS

A. General

The automatic irrigation controllers shall be of an advanced commercial design, with a large, backlit, 8 line by 20 character display, and user-friendly dial-and-button type programming. The controller shall have a removable facepack (containing the user interface and all program memory) which can be easily removed without tools for programming and diagnostics outside the controller enclosure. The controller facepack shall have non-volatile memory, with 9 VDC battery power to enable programming when removed from the enclosure.

The controller interface shall have an Info button to provide text help instructions for each dial position.

The controller shall also have two independently programmable Pump/Master Valve outputs, which may be configured as either Normally Open or Normally Closed. Pump/Master Valve activation combinations shall be programmable by station; each station may have one, two, both, or neither P/MV output configured whenever the station is activated for any reason. Each Pump/Master Valve output shall have a capacity of .325 A @24VAC.

The controller shall have an internal 120/230 VAC transformer of at least 120 volt-amp capacity, and shall have sufficient output capacity (4A @ 24V secondary) to operate up to 14 standard 24 VAC solenoids (12 solenoids plus 2 Pump/Master Valve outputs) simultaneously.

For primary electrical wire sizing assume 2 amp max in 120V installations, 1 amp max in 230V installations. The controller shall have a self-diagnostic circuit breaker to prevent harmful overloads due to field wiring. The controller shall have a replaceable fuse, 6x20mm, 2A, 250V fast blow, and shall be supplied with one spare fuse.

The irrigation controllers shall have 6 automatic programs with 10 automatic start times, each. Start Times shall be set in one-minute increments, and may be set in 24-hour clock or AM/PM time formats. Each program and station may be uniquely named with alphanumeric characters. Automatic programs shall be individually configurable for Overlapping, Stacked, or programmable SmartStacked operation (including SSG/SmartStack operation if this feature is used). SmartStack operation shall permit the

operator to specify the number of programs permitted to overlap before Stacking commences. Automatic programs shall have programmable water day schedules with optional Day of Week, Interval Day (1 to 31 days), or Odd or Even days, by program. Automatic programs shall have user-programmed Non-Water windows to except certain time windows from watering, regardless of the water day schedule. Automatic programs shall also permit the designation of non-water days, even when Odd/Even or Interval Day patterns have been set. Non-water window violations shall be detected and the operator shall be warned when programming irrigation into non-water windows. If the program changes are kept despite the warning, the irrigation shall automatically stop when the non-water window is reached. The controller shall permit run times per station start of between 1 second and 6 hours, in one-second increments. Automatic irrigation shall be capable of Cycle and Soak programming, by station, to minimize runoff. The controller shall also offer programmable delay between stations of up to 6 hours in one-second increments. The controller shall have a programmable Rain Shutdown delay of up to 31 days. Individual programs, or the entire controller, may be adjusted with Season Adjust from 0 to 300% in one percent increments. The controllers shall have 4 additional Custom Manual programs for specialty applications that allow any stations to run in any order, with programmable pauses between stations. Custom Manual programs shall not run automatically but can be started by the operator at any time from the dial controls.

The controller shall have a Quick Check test program, permitting all stations to run sequentially for a user-entered period of time, programmable in one-second increments up to 10 minutes each, for system startup and diagnostics.

The controller shall also save an Easy Retrieve Program which stores all original programming settings. The installing contractor shall be able to restore the system to this saved state at any time after initial installation. The stored Easy Retrieve settings may also be updated at any time by the contractor. The controller shall save and display programmable contact information for the manufacturer, and shall be reprogrammable in the field to display the contact information for the installing or maintaining contractor, to assist future operators in obtaining assistance with the controller.

The controller shall have a one-button manual station advance in Test mode for quick diagnostics checks.

The controllers shall permit stations to be grouped into Simultaneous Station Groups (SSG) for simultaneous activation and programming, in clusters of 2 to 4 stations. SSGs shall be used to reduce programming time, and to consolidate irrigation times when flow and pressure permit. SSGs shall be included in automatic programs with a single run time, in the same fashion as individual stations, but representing the electronic group of similar stations. SSGs may also be assigned alphanumeric names.

The controller shall permit connection of up to 4 switch closure sensors, with programmable response to each sensor, by program. Sensor response may consist of a) Suspend, wherein the controller ceases irrigation, but continues counting "irrigation time" so that it resumes where it should be with no violation of the end of the water window, or b) Pause, wherein the program ceases irrigation but will resume where it left off at time of the Pause input. Each program may respond to each sensor regardless of other programs' status or responses.

The controller shall permit connection of a true flow meter which connects via the master power module of the controller (or via the two-wire path in two-wire decoder

configurations), and which is calibrated by the operator for the pipe diameter in which it is installed. The flow meter shall measure actual flow in gallons or liters. The controller shall have a learning mode in which the controller operates each single station for a short period, learns the actual flow for each station, and stores the information internally by station.

When the learned flow is exceeded during normal operations the controller shall record a flow alarm event, cease irrigating the station or stations contributing to the high or low flow readings, and resume irrigation with any stations which do not cause alarms. The controller shall have the ability to determine high or low flow conditions when multiple stations are operating, and shall perform diagnostics to identify stations which contribute to the problem flow. Allowable limits and duration of incorrect flow shall be preset, but reprogrammable by the operator for unique local conditions. The flow meter shall be a Hunter Industries HFS in an appropriately sized FCT fitting. It shall also be possible to except certain stations from flow monitoring, for non-irrigation devices.

The basic controller shall have a minimum of 12 stations in two modular outputs of six stations each, and shall expand at any time in modular increments of six stations to a maximum capacity of 42 stations.

The controller shall be packaged in a powder-coated metal wall-mount enclosure, with an optional powder-coated steel pedestal mount. The controller shall also be available in a pre-assembled plastic pedestal enclosure. All enclosures shall be suitable for outdoor installation.

Each station output shall have a capacity of up to .56 A @ 24VAC.

Station expansion shall be effected via 6-station modules requiring no tools to install, and only a screwdriver to attach field wiring. All station output modules shall feature transparent plastic housings with colored indicator LEDs showing station status (OK, Running, Faulted). Station output modules shall be furnished with built in, fully encased Metal Oxide Varistor (MOV) surge protection components. Extreme Service (AGM600) output modules shall be furnished with fully encased heavy-duty surge protection, consisting of spark gap and induction coil protection on each output.

Earth grounding shall be connected via a factory supplied copper ground lug inside the controller, for connection to earth ground hardware via 6 AWG (4mm dia.) copper wire (see ASIC Earth Grounding Guideline 100-2002 for details of earth grounding irrigation control systems available online at www.asic.org). Ground wire shall be extended underground, at right angles to any communications wiring, to approved direct burial earth grounding hardware at least 6 ft./2m from the controller location. Earth Ground shall be have an impedance of 10 Ohms or less, or shall meet the standards of the Earth Grounding Guideline cited above.

The controllers shall be equipped with an integrated, pre-wired SmartPort input to permit connection of wireless remote controls and other devices as specified by the manufacturer. Wireless remote control shall permit individual start of individual stations and Programs, and shall also enable remote shut down of all irrigation at the controller.

The controller shall be adaptable to compatible computerized central control systems through an optional communications module, with a selection of common communications media including hardwired cable, UHF radio, dial-up modem, and

cellular telephone. When configured for operation within a central system, the controller shall feature full two-way communications with the central computer. The compatible control system shall be Hunter Industries Model IMMS 2.0 Irrigation Management and Monitoring System.

The controller shall be installed in accordance with the manufacturer's published instructions.

The controller shall be UL and c-UL listed. The controller shall be CE and C-tick approved and shall have WEEE recyclability markings as required.

B. Field Satellite Controllers

All field satellite controllers shall be ACC series with IMMS ACC communication modules noted on the plans as manufactured by Hunter Industries Incorporated, San Marcos, California. Field satellite controllers shall be wall mounted or pedestal type as shown on the plans. All wall mounted and pedestal satellites shall have powder-coated steel cabinets. Controllers shall be model numbers as shown for each specific site on the plans.

The Central Controller shall connect to and operate the first controller in the system via USB cable. The first controller will be located at the Owner's maintenance facility The first controller shall communicate with one controller at the site via UHF radio. Each additional controller on the site shall be sequentially connected downstream with GCBL cable and include the appropriate communications module.

C. Field Satellite Controller Wiring

Field Satellite controllers located at the project site shall be hardwire connected with GCBL communications cable as manufactured by Hunter Industries Incorporated, San Marcos, California. Communications cable shall consist of two twisted pairs of 18 gauge wire and a grounding drain wire. The cable shall be shielded with a foil sheathing under the protective casing to reduce communication interference. The cable shall be designed for direct burial. It shall be buried at lateral line depth. Marking tape shall be installed directly over the top of the installed cable.

2.5 ET SYSTEM

A. General

The control system shall automatically calculate a program and run times for designated stations based on a local evapo-transpiration sensor, connected to a compatible automatic irrigation controller. The ET system shall conserve water and promote healthy plants by calculating climate-based automated irrigation for each zone, using the Management Allowable Depletion methodology recognized by irrigation industry professionals.

The ET system shall include only local evapo-transpiration data, "local data" being defined as sensed climatological conditions within the immediate coverage area of the irrigation system, from a sensor dedicated to that purpose. The ET system shall not require broadcast, subscription, or other generalized weather data, and shall function as

a standalone ET-based irrigation system when directly connected to a compatible automatic irrigation controller of up to 48 stations.

The ET Sensor shall be mounted in an optimum location for measurement of climatological data, and be connected directly to an irrigation controller.

Flow sensors may be connected to the controller for detection of line breaks or other abnormal conditions, but no other "click" type environment sensors shall be connected to the irrigation controller when the ET system is in use.

The ET Sensor shall be pole or post mounted within 100 ft./33m of the irrigation controller. The ET Sensor shall include individual sensors for solar radiation, relative humidity, and air temperature, and shall also include a rain gauge reading in .01"/.254mm increments, and all sensors shall be integrated into a single sensor array. The ET Sensor shall include a programmable built-in Prevailing Wind Compensation factor, switch adjustable, allowing automatic adjustment from 1 to 7 mph/1.6 to 11.2kph for average prevailing winds. [The Prevailing Wind Compensation factor shall be bypassed automatically if ET WIND is connected to the Sensor array.]

The ET system shall automatically terminate irrigation when natural rainfall is sensed, and shall have an adjustable rain shutdown threshold in .01"/.254mm per hour increments. The ET system shall also inhibit irrigation when sensed air temperature nears freezing conditions. The ET system shall measure rainfall and shall add a percentage of natural rainfall to the soil reservoir, to save automatic irrigation water.

When equipped with ET WIND, the ET system shall automatically inhibit irrigation in windy conditions.

The ET Sensor shall be mounted approximately 6 ft./2m above a representative irrigated plant area in direct sunlight, and shall not be mounted within the spray or stream of any irrigation device. The ET Sensor shall connect all power and communications over a single pair of 18 AWG/1mm wires from the controller, and shall not require additional external power connections of any kind.

The user-programmed database shall include station (or zone) specific data for Plant Types, including crop coefficients. The ET system shall provide a menu including typical Turf, Shrub, Groundcover, Vine, Tree, Perennial, and Desert categories of plants, and shall include selection of typical varieties within each category, including representative crop coefficients for up to 32 selected varieties of typical landscape plantings. The Plant Type settings shall also include the ability for the user to create a Custom crop coefficient for each zone.

The user-programmed database shall include station (or zone) specific data for soil, slope, and shade characteristics for each station. The user shall be able to select soil texture based on the Water Use Classifications of Landscape Species (WUCOLS) standards, percentage of slope for prevention of runoff, and degree of sun exposure for adjustment from the sensed solar radiation.

The user-programmed database shall include station (or zone) specific data for each sprinkler type, including Rotors, Sprays, Drip, and Bubblers, and a representative precipitation rate for each type. The ET system shall permit either selection from the menu of typical irrigation devices and precipitation rates, or a customizable precipitation rate for stations or zones which have been measured with catchments.

The ET system shall permit the user to designate permissible days on which to water and a start time for irrigation, if watering events are determined to occur on a permissible water day. The ET system shall have user-selectable automatic Daylight Savings Time adjustment.

The ET system shall perform a look-ahead calculation to check whether upcoming non-water days will cause excess depletion of the soil reservoir, prior to the next permissible water day. The ET system shall also calculate minimum run times by zone, based on soil, plant, and sprinkler type to prevent shallow watering.

The ET system shall update the system ET factor on an hourly basis, and shall accumulate ET and assess watering needs on a daily basis.

The ET system shall permit histories of most recent irrigation events to be viewed with time and date of last irrigation, including total run time and number of cycles, by station.

The ET system shall include an optionally-enabled, ET-based, "WiltGard" feature to prevent plant damage in environmental extremes. The WiltGard feature shall trigger emergency watering outside of the normal day schedule or start time, if the Management Allowable Depletion level is determined to be immediately harmful to the irrigated species, by zone. The irrigation applied in a WiltGard response shall be calculated based on the database for each zone, and such applications shall be added to the soil reservoir for Management Allowable Depletion calculation. The WiltGard feature must be user selectable, and may set On or Off at any time by the system operator.

The controller shall permit Manual override of the daily ET from the control panel, and shall also permit ET-based irrigation to be disabled without disconnection of the Sensor.

The ET system shall permit non-ET adjusted stations to run in the irrigation controller's other programs, on a typical Day-Start-Run Time sequential schedule, provided the ET stations do not overlap the non-ET programs. Connection of the ET system to the irrigation controller shall not inhibit the function of the controller's remote control features for maintenance operations or manual watering.

The ET system shall be fully functional with 24VAC input or less, with a max current draw of 20ma, and shall not require a dedicated high-voltage transformer or connection. The ET system shall be CE [C-tick] approved.

B. ET System

The ET System shall be the ET SENSOR as manufactured by Hunter Industries Incorporated, San Marcos, California. The ET SENSOR shall be compatible with the ACC controller.

2.6 FLOW SENSOR

A. General

The flow shut-off device shall be capable of interrupting the power from the irrigation controller to the valves when flow in the system exceeds a pre-selected highest flow rate or lowest flow rate.

The device shall be of a two-piece configuration with a sensor unit and a programmable interface. The interface shall be built into the irrigation controller. The sensor unit shall be wired to the interface and shall be housed in a PVC sensor body. The sensor bodies shall be available in 1, 1.5, 2, and 3-inch Schedule 40 PVC and 1.5, 2, and 3-inch Schedule 80 PVC.

The sensor shall be of a magnetic impeller-type design. The sensor circuitry shall be housed in a corrosion resistant plastic casing, completely sealed, and waterproof.

The interface shall have a system calibration button that calibrates the sensor to the highest and lowest zone flow while running. All adjustments to the interrupt period and system start-up delay shall be accomplished through the interface. Feedback on system performance shall be provided by LEDs on the interface and shall indicate if power is applied to the device and if flow is acceptable. The programmable interface shall provide for a start-up delay of 20 seconds to 300 seconds to allow for system stabilization before detecting for overflow or low flow conditions. Interrupt period shall be programmable from 5 minutes to 60 minutes, along with a manual reset function.

The device shall be installed in accordance with the manufacturer's published instructions.

B. Flow Sensor

The flow sensor shall be the Flow-Clik as manufactured by Hunter Industries Incorporated, San Marcos, California.

Flow sensors shall be plastic or brass construction and shall be model numbers and sizes as shown for each specific site on the plans.

C. Flow Sensor Cable

All data communications wire connecting flow sensors to interfaces shall be constructed to direct burial specifications.

The cable shall be constructed of 14 AWG, or larger, copper conductors. Conductors shall be insulated with polyethylene or propylene with a suggested working voltage of 300 volts. The cable shall feature a black high-density polyethylene jacket. Cable shall be AEF No. 1214-2 or equal approved in advance by the Owner's Representative. Color shall be red and black matching flow sensor leads.

D. Flow Sensor Cable Splices

All wire connections shall be absolutely watertight with no leakage to ground nor shorting from one conductor to another. All splices shall be made with epoxy-type wire connector kits such as 3M Series 3500 Scotch-LOK connector packs or 3M Series 7000 Epoxy Wire Connector Kits, or equal approved in advance by the Owner's Representative. If one connector is used for both wire connections, make sure that the splices are staggered to prevent shorting. Follow the manufacturer's instructions on the package.

All flow sensor cables shall be continuous, without splices, from the connection at the flow sensor to the interface.

2.7 MASTER VALVES

A. Master Valves

All master valves shall be ICV Series solenoid valves as manufactured by Hunter Industries Incorporated, San Marcos, California.

Master valves shall be model numbers and sizes as shown for each specific site on the plans.

B. Conduit Fittings

All master valves shall include Hunter's solenoid conduit cover fittings for attachment of conduits.

C. Master Valve Wiring

All master valve wire shall be irrigation control cable as manufactured by Paige Electric Co., Box 368, Union, NJ 07083, telephone 800-327-2443 or equal approved in advance by the Owner's Representative. All control cable shall be 14 gauge and all common cable shall be 12 gauge unless otherwise indicated on the drawings, and rated for direct burial applications.

All wiring shall be 600 volt, soft drawn solid copper single conductor wire meeting the requirements of ASTM B-3 or B-8, -55° C to +60° C temperature rated with 0.045" polyethylene insulation. All control cable shall be marked with manufacturer identification, voltage rating, size and type and shall bear UL file number.

All cables shall be tested physically and electrically in accordance with UL Standard 493, and 83, paragraphs 28.1, 29.1 and 29.2. All reels and cartons shall bear UL labels.

All control cable shall run continuously from the controller to the valve without splicing.

Verification of wire types and installation procedures shall be checked to conform to local codes.

D. Master Valve Wiring Connections

All master valve wiring connections shall be made with 3M DBY potted connectors. Provide sealed box for connectors where wiring is entirely enclosed in conduit.

2.8 VALVE BOXES

A. General

All master valves and flow sensors installed outside buildings, unless otherwise indicated, shall be installed in valve access box of proper size as required for easy access to the equipment.

B. Valve Boxes

Standard valve box for all master valves and flow sensors to be Carson 1419-12-4 or NDS 214BCB, maximum 1 unit per box. All covers to be T-Cover type and locking. Provide matching valve box extensions as required. All valve boxes shall be of the same manufacturer. Locking bolts shall be delivered to the Owner unless directed otherwise by the Owner's Representative.

2.9 GROUNDING:

A. General

All satellite controllers shall be properly grounded in accordance with manufacturer's installation requirements.

B. Acceptable Ground

All grounds shall show a ground resistance of 10 ohms or less when tested with a Mugger instrument in accordance with the manufacturer's ground testing specifications. Grounds with greater than 10 ohms resistance, or grounding tests performed with volt/ohm meter shall be rejected.

In the event of ground rejection Contractor shall install additional ground rods or take other action as necessary and perform retesting of ground until acceptable ground is established, all at no additional charge to the Owner.

Demonstrate acceptability of all grounds to the Owner's Representative in person.

C. Materials

All ground rods shall be 5/8" x 8' copper. Ground wires shall be #6 bare copper wire, solid strand. Ground wires shall be attached to ground rods with Cadweld connectors. All ground rods shall be housed in Carson 708-9-4.

2.10 ANTENNAS

A. General

Antenna types specified herein are preliminary. Contractor shall perform a site radio survey. Signal strength shall be verified from the ICCS to the initial satellite controller in strict accordance with Manufacturers testing requirements before antennas are ordered for installation.

B. Antenna Schedule

Owner's maintenance facility:

ACC Controller	IMMSANT3 - roof mount

Centennial Park:

Initial ACC Controller IMMSANT3 – post mount

C. Poly-phasers

All ANT3 antennas shall be equipped with poly-phaser lightening protection.

Poly-phasers shall be Surge Arrestor Model # IS-B50LU-C1 as manufactured by Polyphaser, or equal approved in advance by the Owner's Representative.

Provide mounting conforming to manufacturers recommended installation for all poly-phasers, including grounding.

2.11 OTHER MATERIALS:

A. Materials to be Furnished

Supply as part of this contract the following tools and materials:

Two keys for each automatic controller.
One spare master valves for each type and size installed.
One spare flow sensors for each type and size installed.

The above equipment shall be turned over to the Owner's Representative at the conclusion of the project before final inspection can occur.

B. Other Materials

All other materials and incidentals, not specifically described but required for a complete and proper irrigation system installation, shall be new, first quality of their respective kinds, and subject to approval in advance by the Owner's Representative.

PART 3 - EXECUTION

3.1 INSPECTIONS AND REVIEWS

A. Inspection

Prior to all work of this section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.

Verify that irrigation control system may be installed in strict accordance with all pertinent codes and regulations, the original design, the referenced standards, and the manufacturer's recommendations.

Verify locations of underground utilities including the existing irrigation system components and control wires in areas where excavation is to occur.

Verify water sources, power sources and other utilities to be connected or used in the work of this contract.

B. Discrepancies

In the event of discrepancy, immediately notify the Owner's Representative.

Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

C. Beginning work of this section implies acceptance of existing conditions.

3.2 IRRIGATION CONTROL SYSTEM LAYOUT REVIEW

A. Before beginning any actual construction activities, lay out the irrigation control system. Make all necessary measurements in the field to ensure precise fit of items in accordance with the original design.

Items staked or marked out are to include: satellite controllers, sleeve locations, communications wire, master valve/flow meter locations, conduit routing, ET System location and electrical power wire routing.

B. Irrigation system layout review will occur after the layout has been completed. Notify the Owner's Representative 2 days in advance of review. Modifications as may be required will be identified by the Owner's Representative at this review.

C. Secure written approval of control system layout from the Owner's Representative before proceeding with installation.

3.3 SLEEVING AND PIPE

A. Install sleeving and buried pipe as specified by Section 02760 of this Specification.

3.4 INSTALLATION OF CONTROL SYSTEM COMPONENTS

A. The locations of the control units depicted on the drawings are approximate; the Contractor, with assistance from the manufacturer's representative, will determine the exact site locations at the system layout review for approval by the Owner's Representative.

B. Contractor shall coordinate all work.

C. Contractor shall extend power as required and make all service connections.

D. Install all central control unit components as called for in the specifications and per manufacturer's recommendations.

E. Install all surge protection as per manufacturer's latest instructions.

F. Install and test all grounding as specified.

3.5 TESTING, PROGRAMMING AND INSPECTION:

A. Closing-in Uninspected Work

Do not allow or cause any of the work in this section to be covered up or enclosed until it has been inspected, tested, and approved by the Owner's Representative.

Where trenches are not closed at the end of the day Contractor shall accept all liability for any damage or injury that may result from open trenches. Provide barricades and warning tape as necessary around all open trenches.

B. System Programming

The field satellites shall be operated in stand-alone mode through the duration of the maintenance period. Contractor shall establish communication between existing CICS and the field satellites. Contractor shall coordinate with Owner to install ET software and confirm operation of ET SENSOR. The CICS shall be programmed to communicate with the field satellites daily to retrieve ET data. The data will not be used by the Contractor.

Field satellites shall be programmed in the field by the Contractor. Programming shall be appropriate to the types of sprinkler equipment installed in the field, including flow sensors, and shall make use of all features available from the control system.

Contractor shall complete system manufacturer's ET Worksheets for each satellite installed. Worksheets shall be completed digitally and submitted in a digital as well as hard copy format with the O & M manuals.

C. Testing and Adjustment

Thoroughly clean, adjust, and balance all systems. Test all systems for proper functioning for a minimum one week (7 days) automatic operation of irrigation cycles. Readjust as required before inspection.

Verify that all systems are fully adjusted and balanced, and completely operational as intended before final inspection.

D. Final Inspection

Demonstrate the entire system to the Owner's Representative, proving that all central control system components are operating as intended, and that the installed system is workable, clean, and efficient.

3.6 INSTRUCTIONS

A. Record Drawings

Record accurately on one set of black and white prints of the plans all changes to installed work.

Upon completion of each increment of work, transfer all such information and dimensions to the reproducible record drawing. The dimensions shall be recorded in a legible and workmanlike manner.

Maintain as-built drawings on site at all times.

Make all notes on drawing in pencil (no ball point pen). When the work has been completed, transfer all information from the field record print to a set of reproducible drawings.

B. Operation and Maintenance Manuals

Coordinate with requirements of Section 01705 to provide the following:

Prepare and deliver to the Owner's Representative within ten calendar days prior to completion of construction, four individually bound copies of the operations and maintenance manual.

The manual shall describe the material installed and shall be in sufficient detail to permit operating personnel to understand, operate and maintain all equipment. Spare parts lists and related manufacturer information shall be included for each equipment item installed. Each complete, bound manual shall include the following information.

- Index sheet stating Contractor's address and telephone number, duration of guarantee period, list of equipment with names and addresses of local manufacturer representatives.
- Complete operating and maintenance instructions on all major equipment.
- Complete parts lists and tables for all major equipment installed.
- Print outs showing initial programming settings of each field satellite.
- ET Worksheets

Instruct the Owner's designated personnel in the operation and programming of the system. Show written evidence to the Owner's Representative at the conclusion of the project that this service has been rendered.

3.7 DISPOSAL OF WASTE MATERIAL

A. Maintain work site clean and free of debris at all times. Keep premises free of debris and unusable materials. As work progresses, or at the request of the Owner's Representative, remove waste materials from the site.

B. Maintain disposal route clear, clean and free of debris. Stockpile, haul from site and legally dispose of waste materials, including unsuitable excavated materials, rock, trash and debris.

END OF SECTION

SECTION 02821-CHAIN-LINK FENCES AND GATES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Chain-Link Fences: Industrial
   2. Gates: Swing

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Show locations, components, materials, dimensions, sizes, weights, and finishes of components. Include plans, gate elevations, sections, details of post anchorage, attachment, bracing, and other required installation and operational clearances.

PART 2 - PRODUCTS

2.1 CHAIN-LINK FENCE FABRIC

A. General: Height indicated on Drawings. Comply with ASTM A 392, CLFMI CLF 2445, and requirements indicated below:
   1. Steel Wire Fabric: Metallic coated 9 gauge wire with a diameter of 0.148 inch (3.76 mm), galvanized after weaving (GAW).
      a. Mesh Size: 2 inches (50 mm).
      b. Metallic (Zinc) Coating: ASTM A 392, Type II.
   2. Selvage: Twisted top and knuckled bottom.

2.2 INDUSTRIAL FENCE FRAMING

A. Posts and Rails: Comply with ASTM F 1043 for framing, ASTM F 1083 for Group IC round pipe, and the following:
   1. Group: IC, round steel pipe, yield strength 50,000 psi (345 MPa)
   2. Coating for Steel Framing:
      a. Metallic coating.

2.3 TENSION WIRE

A. General: Provide horizontal tension wire at bottom of fence fabric.

B. Metallic-Coated Steel Wire: 0.177-inch- (4.5-mm-) diameter, marcelled tension wire complying with ASTM A 817 and ASTM A 824.
   1. Metallic Coating: Type III, Zn-5-Al-MM alloy.

2.4 INDUSTRIAL SWING GATES

A. General: Comply with ASTM F 900 for swing gate types.
   1. Metal Pipe and Tubing: Galvanized steel. Comply with ASTM F 1083 and ASTM F 1043 for materials and protective coatings.

B. Frames and Bracing: Fabricate members from round, galvanized steel tubing with outside dimension and weight according to ASTM F 900 and the following:
   1. Gate Fabric Height: 2 inches (50 mm) less than adjacent fence height.
   2. Leaf Width: As indicated.
   3. Frame Members:
      a. Tubular Steel: 1.66 inches (42 mm) round, full weight

C. Frame Corner Construction:
   1. Welded and 5/16-inch diameter, adjustable truss rods for panels 5 feet (1.52 m) wide or wider].

D. Extended Gate Posts and Frame Members: Extend gate posts and frame end members above top of chain-link fabric at both ends of gate frame 14 inches (300 mm) as required to attach barbed wire assemblies.

E. Hardware: Latches permitting operation from both sides of gate, hinges, center gate stops and keepers for each gate leaf more than 5 feet (1.52 m) wide. Fabricate latches with integral eye openings for padlocking; padlock accessible from both sides of gate.

F. Gate stops: Post and hardware to retain gate in open position.

2.5 FITTINGS

A. General: Comply with ASTM F 626.

B. Finish:
   1. Metallic Coating for Pressed Steel or Cast Iron: Not less than 1.2 oz. /sq. ft. (366 g /sq. m) zinc.
   2. Aluminum: Mill finish.

2.6 BARBED WIRE

A. Zinc-Coated Steel Barbed Wire: Comply with ASTM A 121; 12.5 gauge 4-point round barbs spaced not more than 5 inches (127 mm) o.c..

2.7 FENCE GROUNDING

A. Conductors: Bare, solid wire for No. 6 AWG and smaller; stranded wire for No. 4 AWG and larger.
   1. Material above Finished Grade: Copper.
   2. Material on or below Finished Grade: Copper.
   3. Bonding Jumpers: Braided copper tape, 1 inch (25 mm) wide, woven of No. 30 AWG bare copper wire, terminated with copper ferrules.

B. Connectors and Grounding Rods: Comply with UL 467.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install chain-link fencing to comply with ASTM F 567 and more stringent requirements specified.

B. Post Excavation: Drill or hand-excavate holes for posts to diameters and spacings indicated, in firm, undisturbed soil.

C. Post Setting: Set posts in concrete at indicated spacing into firm, undisturbed soil.
1. Concrete Fill: Place concrete around posts to dimensions indicated and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.

D. Terminal Posts: Locate terminal end, corner, and gate posts per ASTM F 567 and terminal pull posts at changes in horizontal or vertical alignment.

E. Line Posts: Space line posts uniformly at 10 feet (3 m) o.c.

F. Post Bracing and Intermediate Rails: Install according to ASTM F 567. Install braces at end and gate posts and at both sides of corner and pull posts.

G. Tension Wire: Install according to ASTM F 567, maintaining plumb position and alignment of fencing.

H. Top Rail: Install according to ASTM F 567.

I. Chain-Link Fabric: Apply fabric to outside of enclosing framework. Leave 2 inches (50 mm) between finish grade or surface and bottom selvage, unless otherwise indicated.

J. Tie Wires: Attach wire per ASTM F 626. Bend ends of wire to minimize hazard to individuals and clothing.

K. Fasteners: Install nuts for tension bands and carriage bolts on the side of the fence opposite the fabric side. Peen ends of bolts or score threads to prevent removal of nuts.

L. Barbed Wire: Uniformly spaced, angled toward security side of fence. Pull wire taut and install securely to extension arms and secure to end post or terminal arms.

3.2 GATE INSTALLATION

A. Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference. Attach fabric as for fencing. Attach hardware using tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation and lubricate where necessary.

3.3 GROUNDING AND BONDING

A. Fence Grounding: Install at maximum intervals of 1500 feet (450 m).

B. Fences within 100 Feet (30 m) of Buildings, Structures, Walkways, and Roadways: Ground at maximum intervals of 750 feet (225 m).
1. Grounding Method: At each grounding location, drive a grounding rod vertically until the top is 6 inches (150 mm) below finished grade. Connect rod to fence with No. 6 AWG conductor. Connect conductor to each fence component at the grounding location.

C. Bonding Method for Gates: Connect bonding jumper between gate post and gate frame.
1. Connections: Make connections so possibility of galvanic action or electrolysis is minimized.

PART 4 - MEASUREMENT AND PAYMENT

4.1 GENERAL

A. See Section 01275: Measurement and Payment.

END OF SECTION 02821

SECTION 02822 - TURF SEEDED LAWNS

PART 1 - GENERAL

1.1 DESCRIPTION:

Work in this section consists of furnishing all plant, labor, equipment, and performing all operations in connection with finish grading of topsoil and preparation thereof to receive seed, seeding of lawn areas, maintenance and protection of all planting areas.

All exterior lawn areas within the seeding limits, except surfaces occupied by buildings and structures and paving, except areas indicated to be undisturbed shall be seeded as shown on Plans.

1.2 RELATED WORK DESCRIBED ELSEWHERE:

Irrigation System - Section 02760

1.3 QUALITY ASSURANCE:

A. Qualifications of Workmen

Provide at least one person who shall be present at all times during execution of this portion of the work and who shall be thoroughly familiar with the type of materials being installed and the best methods for their installation and who shall direct all work performed under this section.

1.4 PRODUCT HANDLING:

A. Protection

All seed shall be delivered to the job site in the original bags with tags certifying purity, germination, common and botanical name for each species, and percent weed seed. All tags shall be removed from the bags by the Owner's Representative. Untagged seed bags shall be rejected.

B. Replacements

In the event of rejection of the seed, immediately make all replacements necessary to the approval of the Owner's Representative and at no additional cost to the Owner.

D. Notice to Proceed

The Contractor shall not proceed with seeding operations until the irrigation system has been tested and approved by the Owner's Representative.

E. Schedules

Irrigated areas may be seeded any time between April 15 and August 31, provided that the irrigation system is operational.

If special conditions exist that may warrant a variance in the specified plant dates or conditions, a written request shall be submitted to the Owner's Representative stating

the special conditions and proposed variance.

F. Substitutions

Requests for substitutions, along with price and adjustment quotes, shall be submitted in writing to the Owners Representative after the contract has been awarded. All requests are subject to the approval of the Owners Representative.

1.5 SUBMITTALS

A. Certification: Provide product data on the following materials:

1. Seed mixes, including manufacturer's product information.

PART 2 - MATERIALS

2.1 SEED:

A. General

All grass seed shall be:

Free from noxious weed seeds, and recleaned;

Grade A recent crop seed;

Treated with appropriate fungicide;

Delivered to the site in sealed containers with dealer's guaranteed analysis.

B. Lawn Grass Mixture:

Scott's Thermal Blue Grass Mix with the following varities:

Name of Grass	Proportion by Weight
Thermal Blue	25%
Solar Green	25%
Thermal Blue Blaze	25%
Dura Blue Blend	25%

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS:

A. Inspection

Prior to all work of this section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.

Verify that seeding may be completed in accordance with the original design and the referenced standards.

B. Discrepancies

In the event of discrepancy, immediately notify the Owner's Representative.

Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

Beginning of installation means acceptance of existing conditions by installer.

3.2 SPREADING OF TOPSOIL:

A. Finish Grading

Place a minimum of 4 inches of topsoil at all lawn areas prior to seeding. Grade lawn areas to finish grades, filling as needed or removing surplus dirt and floating areas to a smooth uniform grade. All lawn areas shall slope to drain. Where no grades are shown, surfaces shall have a smooth and continual grade between existing or fixed controls (such as walks, curbs, catch basins, elevations at steps or building). Roll, scarify, rake and level as necessary to obtain true even lawn surfaces. All finish grades shall meet approval of the Owner's Representative before grass seed is sown.

B. Fine Grading

Upon completion of finish grading, perform all fine grading required in planting areas, using topsoil obtained from the site.

3.3 SOWING LAWN GRASS:

A. Preparation

Seed bed preparation shall pertain to the preparation of the surface of the ground to receive the seed. The ground shall be hand or machine raked so as to remove all debris, clods, rocks, and other material larger than 1-inch, to a depth of 4-inches. Such debris, clods, rocks, and other material so removed shall be disposed of off the immediate property. Seed bed preparation shall not commence until the moisture conditions make the ground area and soil friable.

If there has been a time lapse following the placement of the topsoil to allow it to become settled and compacted on the surface, the area to be planted with seed shall be thoroughly worked to a depth of 3 to 4 inches so as to provide a surface of such condition that it will allow application of the seed in compliance with these Specifications.

Seed beds should be permitted to settle or should be firmed by rolling before seedings are made.

B. Sowing

Immediately prior to the application of the seed, the soil shall be loose to a depth of at least one inch and free from all material as specified. If soil is too loose or dry for good handling, it should be moistened and rolled lightly.

Seed shall be sown in at no more than ¼" depth at the rate of 2.75 pounds of lawn grass mixture per 1,000 square feet, exercising great care that a uniform distribution of seed is obtained. Seeding shall be done on a still day, using a seed drill, one-half of the seed (1.375 lbs.) for each area being sown in a direction at right angles to the other half.

Sprinkle immediately after sowing with a fine spray until ground is thoroughly saturated, with particular care to avoid runoff on sloping areas.

The surface layer of soil must be kept damp by frequent light watering with a fine spray during the germination period after seeding and until the young plants are rooted firmly.

C. Protection

Protect all seeded areas by erecting temporary fences, barriers, signs, etc. as necessary to prevent traffic. Barriers shall remain in place for at least six (6) weeks unless other arrangements are made with the Owner's Representative.

3.4 MAINTENANCE:

A. General

Maintain all lawn areas until final completion of the job but in no case less than 30 days. Seeded lawn shall be maintained a minimum of 30 days following germination.

B. Work Included

All areas shall be watered as required.

All areas shall be watched closely so that they are not permitted to dry out or to form puddles of water, or to be washed by over-application.

Mow all turf lawns at 2" each time its height reaches 2-3/4". Maintain through minimum three mowings to provide an even stand over the entire seeded area. Continue mowing all lawns until acceptance.

C. Replacements

Any area that fails to produce an adequate stand of grass shall be reseeded by the Contractor at no additional expense to the Owner.

Replacements required because of vandalism or other causes beyond the control of the Contractor are not part of the Contract.

D. Extension of Maintenance Period

Continue the maintenance period at no additional cost to the Owner until all previously noted deficiencies have been corrected, at which time the final inspection shall be made.

END OF SECTION 02822

SECTION 02823 - SOD LAWNS

PART 1 - GENERAL

1.1 DESCRIPTION:

Work in this section consists of furnishing all plant, labor, equipment, and performing all operations in connection with finish grading of topsoil and preparation thereof to receive sod, maintenance and protection of all sodded areas.

All drain swales in irrigated lawn areas shall be sodded.

1.2 RELATED WORK DESCRIBED ELSEWHERE:

Irrigation System - Section 02760

1.3 QUALITY ASSURANCE:

A. Qualifications of Workmen

Provide at least one person who shall be present at all times during execution of this portion of the work and who shall be thoroughly familiar with the type of materials being installed and the best methods for their installation and who shall direct all work performed under this section.

1.4 PRODUCT HANDLING:

A. Protection

Upon delivery of sod to the work site use all means necessary to protect and maintain the sod before, during, and after installation and to protect the installed work and materials of all other trades.

B. Replacements

In the event of rejection of the sod, immediately make all replacements necessary to the approval of the Owner's Representative and at no additional cost to the Owner.

C. Notice to Proceed

The Contractor shall not proceed with sodding operations until the irrigation system has been tested and approved by the Owner's Representative and the finish grade has been approved by the Owner's Representative.

D. Schedule

Sod may be placed at any time when the ground is not frozen and the irrigation system is operational and will remain so for 6 weeks minimum.

1.5 SUBMITTALS

A. Certification: Provide product data on the following materials:

1. Seed mixes, including manufacturer's product information.

PART 2 - MATERIALS

2.1 SOD:

A. General

Grass and sod shall be well established lawn grass turf of approved grasses. It shall be vigorous, well-rooted, healthy turf, free from disease, insect pests, weeds, other grasses, stones, and any other harmful or deleterious matter. Cut sod in uniformly wide strips, uniformly 1-1/2 inches thick with clean cut edges. Sod shall be rolled or folded prior to lifting. Handling of sod shall be done in a manner that will prevent tearing, breaking, drying, or any other damage.

Sod shall be installed in place on the site not more than 24 hours after cutting.

B. Material

Minimum 75 percent bluegrass and not less than 85 percent permanent grass suitable to the climate; not more than 5 percent weed and undesirable grasses; free from roots, stones, and foreign materials. Subject to approval by the Owner's Representative.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS:

A. Inspection

Prior to all work of this section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.

Verify that seeding may be completed in accordance with the original design and the referenced standards.

B. Discrepancies

In the event of discrepancy, immediately notify the Owner's Representative.

Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

Beginning of installation means acceptance of existing conditions by installer.

3.2 GRADING:

A. Finish Grading

Grade lawn areas to finish grades with a minimum of 4 inches of topsoil, filling as needed or removing surplus dirt and floating areas to a smooth uniform grade. All lawn areas shall slope to drain. Where no grades are shown, surfaces shall have a smooth and continual grade between existing or fixed controls (such as walks, curbs,

catch basins, elevations at steps or building). Roll, scarify, rake and level as necessary to obtain true even lawn surfaces. All finish grades shall meet approval of the Owner's Representative before sod is laid.

B. Fine Grading

Upon completion of finish grading, perform all fine grading required in planting areas, using topsoil obtained from the site.

3.3 SODDING:

A. Preparation

Bed preparation shall pertain to the preparation of the surface of the ground to receive the sod. The ground shall be hand or machine raked so as to remove all debris, clods, stones, or other foreign matter larger than 1 inch. Such debris, clods, rocks, and other material so removed shall be disposed of off the immediate property. Bed preparation shall not commence until the moisture conditions make the soil friable.

If there has been a time lapse since the placement of the topsoil to allow it to become settled and compacted on the surface, the area to be planted shall be thoroughly worked to a depth of 3 to 4 inches so as to provide a surface of such condition that it will allow application of the sod in compliance with those specifications.

Beds should be permitted to settle or should be firmed by rolling before sodding.

B. Application

A string or line of boards may be used as a guide for setting the first line of sod across the area. Sods of the next course are matched against the edge of this first line in such a way that the joints between the individual sod pieces in the two lines do not coincide. Successive courses are matched against the last line laid, in the same manner. All work should be done on boards laid on top of the sod to avoid footprints or other injuries to the surface.

All sod is to be laid on topsoiled areas. The joint shall be closely laid. Lay sod across slope. Roll or firmly but lightly, tamp with suitable wooden or metal tamper, all new sod sufficiently to set or press sod into underlying soil. After sodding is completed, clean up and thoroughly moisten newly sodded areas.

C. Protection

Protect all sod by erecting temporary fences, barriers, signs, etc. as necessary to prevent traffic. Barriers shall remain in place for at least six (6) weeks unless other arrangements are made with the Owner's Representative.

3.4 MAINTENANCE:

A. General

Maintain all lawn areas until final completion of the job but in no case less than 30 days.

B. Work Included

All areas shall be watered as required.

All areas shall be watched closely so that they are not permitted to dry out or to form puddles of water, or to be washed by over-application.

Mow all sod at 2" each time its height reaches 2-3/4". Maintain through minimum three mowings to provide an even stand over the entire seeded area. Continue mowing all lawns until acceptance.

C. Replacements

Any area that fails to produce an adequate stand of grass shall be resodded by the Contractor at no additional expense to the Owner.

Replacements required because of vandalism or other causes beyond the control of the Contractor are not part of the Contract.

D. Extension of Maintenance Period

Continue the maintenance period at no additional cost to the Owner until all previously noted deficiencies have been corrected, at which time the final inspection shall be made.

END OF SECTION 02823

SECTION 02824 – DRYLAND SEEDED AREAS

PART 1 - GENERAL

1.0 DESCRIPTION:

Work in this section consists of furnishing all plant, labor, equipment, and performing all operations to finish grade topsoil, to prepare seedbeds, seed dryland grass, and maintenance and protection of all planted areas.

All areas disturbed by construction shall be seeded with dryland mix unless noted otherwise on the plans.

1.2 RELATED WORK DESCRIBED ELSEWHERE:

Turf Seeded Lawns	Section 02822
Sod Lawns	Section 02823

1.3 QUALITY ASSURANCE:

A. Qualification of Workmen:

Provide at least one person who shall be present at all times during execution of this portion of the work and who shall be thoroughly familiar with the type of materials being installed and the best methods for their installation and who shall direct all work performed under this section.

1.4 PRODUCT HANDLING:

A. Protection:

1. All seed shall be delivered to the job site in the original bags with tags certifying purity, germination, common and botanical name for each species, and percent weed seed. All tags shall be removed from the bags by the Owner's Representative. Untagged seed bags shall be rejected.

2. All hydromulch, hydromulch tackifier shall be delivered to the job site in the original unopened packaging.

B. Storage:

Seed, hydromulch, hydromulch tackifier and fertilizer shall be kept in dry storage away from contaminants.

C. Replacements:

In the event of rejection of the seed immediately make all replacements necessary to the approval of the Owner's Representative and at no additional cost to the Owner.

D. Notice to Proceed:

The Contractor shall not proceed with seeding until the seedbed has been approved by the Owner's Representative.

E. Schedules:

Non-irrigated areas shall be seeded between March 1 and March 31 or between October 15 and October 31.

Install seed mixes during the specified time periods. If special conditions exist that may warrant a variance in the specified plant dates or conditions, a written request shall be submitted to the Owner's Representative stating the special conditions and proposed variance.

F. Substitutions:

All requests for substitutions shall be submitted in writing to the Owner's Representative stating the special conditions and proposed variance in accordance with Section 01605.

1.5 SUBMITTALS

A. Certification: Provide product data on the following materials:

1. Seed mixes, including manufacturer's product information.

2. Mulch and tackifier.

PART 2 - MATERIALS

2.1 SEED:

A. General:

All grass seed shall be:

1. Free from noxious weed seeds, and recleaned;

2. Grade A recent crop seed;

3. Treated with appropriate fungicide;

4. Delivered to the site in sealed containers with dealer's guaranteed analysis.

B. Dryland Grass Mixture:

COMMON NAME	% OF MIX BY PLS COUNT
Brigade Hard Fescue	35%
Ephraim Crested Wheatgrass	20%
Talon or Reubens Canada Bluegrass	20%
MX86 Sheep Fescue	15%
Sodar Streambank Wheatgrass	10%

2.2 MULCH:

All mulch for hydroseeding shall be Fiber Mulch as manufactured by Thermoguard Company, 451 Charles St., Billings, MT 59101 (Telephone: 406-252-1938).

2.4 MULCH TACKIFIER:

All mulch tackifier shall be Fisch-Stik as manufactured by Chemstar Products Inc., 43915 Hiawatha Avenue South, Minneapolis, Minnesota 55406 (Telephone: 612-722-0079).

2.5 WATER:
Water shall be available from the Water Distribution System. Contractor shall make all arrangements for temporary metering, use, and payment for water with the effected utility.

PART 3 - EXECUTION:

3.1 SURFACE CONDITIONS:

A. Inspection:

1. Prior to all work of this section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.

2. Verify that seeding or sodding may be completed in accordance with the original design and the referenced standards.

B. Discrepancies:

1. In the event of discrepancy, immediately notify the Owner's Representative.

2. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

3. Beginning of installation means acceptance of existing conditions by installer.

3.2 FINISH GRADING:

A. Finish Grading:

Place a minimum of 4 inches of topsoil at all dryland areas prior to seeding. Grade areas to finish grades, filling as needed or removing surplus dirt and floating areas to a smooth uniform grade. All areas shall slope to drain. Where no grades are shown, surfaces shall have a smooth and continual grade between existing or fixed controls (such as walks, curbs, catch basins, elevations at steps or building). Roll, scarify, rake and level as necessary to obtain true even surfaces. All finish grades shall meet approval of the Owner's Representative before grass seed is sown.

B. Weed Control:

1. Prior to application of seed the seedbed shall be roughed up to a depth of 1/8th inch.

2. Moisten the seedbed to a depth of 1" to promote germination of any seeds contained in the topsoil.

3. After weeds have germinated and are growing vigorously, spray with Roundup in strict conformance with manufacturers specifications. Seeding shall be executed 7 days following Roundup application. Do not disturb the sterilized seedbed in any way prior to seeding.

3.3 SOWING DRYLAND GRASS:

A. Preparation:

1. Seed bed preparation shall pertain to the preparation of the surface of the ground to receive the seed. The ground shall be hand or machine raked so as to remove all debris, clods, rocks, and other material larger than l inch from the surface. Such debris, clods, rocks, and other material so removed shall be disposed of off the immediate property in a legal manner. Seedbed preparation shall not commence until the moisture conditions make the ground area and soil friable.

2. If there has been a time lapse following the placement of the topsoil to allow it to become settled and compacted on the surface, the area to be planted with seed shall be thoroughly worked to a depth of 3 to 4 inches so as to provide a surface of such condition that it will allow application of the seed in compliance with these Specifications.

3. Seed beds should be permitted to settle or should be firmed by rolling before seedings are made.

B. Sowing:

1. Immediately prior to the application of the seed, the soil shall be loose to a depth of at least l inch and free from all material as specified. If soil is too loose or dry for good handling, it should be moistened and rolled lightly.

2. Seed shall be sown at the rate of 60 Pure Live Seeds (PLS) dryland grass mixture per square foot exercising great care that a uniform distribution of seed is obtained. Seeding shall be done on a still day, using a seed drill, one-half of the seed for each area being sown in a direction at right angles to the other half.

C. Mulching:

1. Mulch all seeded areas.

Topsoil or seed which washes out for reasons attributable to the Contractor's activities or failure to take proper precautions, shall be replaced at the Contractor's expense.

2. All structures shall be protected from hydraulic application of mulch material. Any material deposited on walks, streets, inlets, or other structures shall be removed by the Contractor, to the satisfaction of the Owners' Representative, at no cost to the Owner.

3. Mulch shall not be applied in the presence of free surface water, but may be applied on damp ground.

4. Mulch shall be mixed with water at a rate of one pound mulch (dry weight) to two gallons of machine water capacity.

5. Mulch shall be applied uniformly as per manufacturer's recommendations at a minimum rate of 2000 pounds per acre.

6. In locations where mulch is indicated on the plans as being increased, mulch shall be applied uniformly as per manufacturer's recommendations at a minimum rate of 3000 pounds per acre.

D. Tackifier:

1. Mulch tackifiers shall be mixed with water at a rate specified by the manufacturer and shall be applied at a minimum rate of 40 pounds per acre.

2. In locations where tackifier is indicated on the plans as being increased, mulch tackifiers shall be mixed with water at a rate specified by the manufacturer and shall be applied at a minimum rate of 80 pounds per acre.

E. Protection:

Protect all seeded areas by erecting temporary fences, barriers, signs, etc. as necessary to prevent all traffic. Barriers shall remain in place for at least six (6) weeks unless other arrangements are made with the Owner's Representative.

3.4 MAINTENANCE:

A. General:

Maintain all dryland grass areas until final completion of the job but in no case less than 6 weeks.

B. Work Included:

Maintain protection to preclude any traffic across seeded area. Should any damage occur repair as directed by the Owners' Representative at no cost to the Owner.

Remove protection at the end of the maintenance period.

C. Replacements:

1. Any area that fails to produce an adequate stand of grass within two growing seasons shall be reseeded by the Contractor at no additional expense to the Owner. Stand adequacy shall be judged by the Owners' Representative, and his opinion shall be final.

2. Replacements required because of vandalism or other causes beyond the control of the Contractor are not part of the Contract.

D. Extension of Maintenance Period:

Continue the maintenance period at no additional cost to the Owner until all previously noted deficiencies have been corrected, at which time the final inspection shall be made.

END OF SECTION 02824

SECTION 02840 - TREES, SHRUBS AND GROUND COVERS

PART 1 - GENERAL

1.1 DESCRIPTION:

The work of this section consists of furnishing all plants, labor, equipment, and performing all planting of trees, shrubs and groundcovers.

1.2 RELATED WORK DESCRIBED ELSEWHERE:

Irrigation System	- Section 02760
Turf Seeded Lawns	- Section 02822
Sod Lawns	- Section 02823

1.3 QUALITY ASSURANCE:

A. Qualification of Workmen

Provide at least one person who shall be present at all times during execution of this portion of the work and who shall be thoroughly familiar with the type of materials being installed, the best methods for their installation, and who shall direct all work performed under this section.

B. Coordination of Work

All work of this section, and the installation of all irrigation systems and all lawns shall be performed by one Contractor.

1.4 STANDARDS:

All plants and planting materials shall meet or exceed the Specifications of federal, state, and county laws requiring inspection for plant disease and insect control. Quality and size shall conform with the current edition of American Standards for Nursery Stock, ANSI Z60.1, as adopted by the American Association of Nurserymen, and with the schedule shown on the plans.

All plants shall be true to name and one of each bundle or lot shall be tagged with the name and size of the plants in accordance with the standards of practice of the American Association of Nurserymen. In all cases, botanical names shall take precedence over common names.

1.5 SUBMITTALS:

A. Samples

Before any mulch is delivered to the job site, submit a 1 cubic foot minimum sample of the proposed mulch to the Owner's Representative for approval.

B. Materials

Before any planting materials are delivered to the job site, submit to the Owner's Representative a complete list of all plants and other items proposed to be installed. Include complete data on source, size, and quality. Demonstrate complete conformance with the requirements of this section.

This shall in no way be construed as permitting substitution for specific items described in the plans or these Specifications unless the substitution has been approved in advance by the Owner's Representative.

C. Record Drawings

During the course of the installation, carefully record in red line on a print of the planting plans all changes made to the planting system layout during installation. Deliver this drawing to the Owner's Representative at final inspection.

D. Certificates

All certificates required by law shall accompany shipments. Upon delivery of plants, deliver all certificates to the Owner's Representative.

1.6 PRODUCT HANDLING:

A. Delivery and Storage

Deliver all items to the site in their original containers with all labels intact and legible at time of inspection. The Owner's Representative shall designate a storage or holding area. Upon delivery of plants the Contractor shall protect and maintain the plant materials until they are planted.

Immediately remove from the site all plants which are not true to name and all materials which do not comply with the provisions of this section of these specifications.

Use all means necessary to protect plant materials before, during and after installation and to protect the installed work and materials of all other trades.

1.7 INSPECTION:

The Contractor shall inform the Owner's Representative prior to starting his planting operation allowing enough time for the Owner's Representative to provide inspection of the operation. The Contractor will notify the Owner's Representative as each operation is completed and request inspection and approval prior to initiating any additional work.

PART 2 - MATERIALS

2.1 PLANT MATERIALS:

A. General

Plant materials shall mean trees, shrubs, groundcovers and plants of all descriptions, required to be furnished for the project, in accordance with the plans and specifications. All plant material must be true to name, which shall conform to Standardized Plant Names of the American Joint Committee on Horticultural Nomenclature, and shall be

legibly tagged with the name and size of the material according to the general nursery practice as recommended by the American Association of Nurserymen.

All plants shall be first class representatives of their normal species or varieties. Unless otherwise specified, plants shall have average or normally developed branch systems and vigorous root systems. Plants shall be free from scale, disfiguring knots, sun scald injuries, abrasions of the bark, or other objectionable blemishes. Weak plants will not be accepted. Plants must show appearance of normal health and vigor in strict accordance with these Specifications. All stock shall be nursery grown.

All plant material shall comply with state and federal laws with respect to inspection for plant disease and infection. Any inspection certificates required by law shall accompany each shipment, invoice, or order of stock.

When planted in masses, plants shall be subject to tests that will eliminate more than twenty (20%) percent variance from uniform size and that will ensure at least fifty (50%) percent conformity to larger rather than smaller sizes (i.e., 8' - 10').

B. Inspection

All plant material shall be subject to approval and inspection at any place, before, during and/or after planting. Any plant material not approved by the Owner's Representative shall be immediately removed from the site. No plant material shall be accepted with loose or broken balls.

2.2 OTHER MATERIALS:

A. Guying Materials

Stakes shall be 2" x 2" fir stakes or 3/4-inch steel rebar, minimum length 3-feet, with the exposed portion of the stake painted dark green or brown. Guys shall be pliable No. 12 gauge galvanized soft steel wire. Hose for covering wire shall be new or used two-ply rubber green hose not less than 1/2-inch diameter.

B. Mulch

Mulch shall be shredded bark for all shrub and tree beds. Submit samples for approval prior to installation.

C. Peat

Peat shall be Sphagnum peat, sedge peat moss. Furnish air-dried, finely shredded, pH between 5.5 and 6.5, containing no more than thirty-five (35%) percent moisture by weight.

D. Weed Barrier Fabric

Weed barrier fabric shall be Typar 3301, as manufactured by Reemay, 70 Old Hickory Blvd., Old Hickory, TN 37138 telephone 800-284-2780 or approved equal.

E. Root Barrier Fabric

Root barrier fabric shall be Biobarrier II, as manufactured by Reemay, 70 Old Hickory Blvd., Old Hickory, TN 37138 telephone 800-284-2780 or approved equal.

2.3 PLANTING MIXTURE:

A. Topsoil

The topsoil shall be loose, friable, and shall contain an ordinary amount of humus. It shall contain no lumps of soil, rocks larger than 1 inch, or sticks, roots, and other debris. It shall be sufficiently fertile to sustain normal healthy plant growth and shall not have a pH value higher than 7.0 or lower than 5.5. The topsoil shall be delivered in an unfrozen and non-muddy condition and must meet the approval of the Owner's Representative.

B. Preparation

Planting mix used as fill around plants shall be mixed with peat moss at the rate of three parts soil to one part peat. All planting mix shall be blended in batches, not mixed in the plant pits. The above mixture is mixed with Sierra Blend 16-8-12 plus minors, as manufactured by Grace/Sierra, 1001 Yosemite Drive, Milpitas, CA 95035 telephone 1-800-492-8255 or approved equal slow release fertilizer at rates as recommended by the manufacturer.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS:

A. Inspection

Prior to all work of this section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence. Verify that planting may be completed in accordance with the original design and the referenced standards.

B. Discrepancies

In the event of discrepancy, immediately notify the Owner's Representative. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

Beginning of installation means acceptance of existing conditions by installer.

3.2 PLANTING TREES AND SHRUBS:

A. General

Plant nursery stock immediately upon delivery to the site and approval by the Owner's Representative except that, if this is not feasible, heal-in all balled material with damp soil and protect from sun and wind. Regularly water all nursery stock in containers, and place them in a cool area protected from sun and drying winds.

B. Excavation of Plant Holes

Excavation shall be accomplished in such a manner as to provide a 1 inch drop from all pavements to the finished surface of beds. Excavate shrub pits to provide not less than 6 inches of planting mixture beyond the side of the container and at least 6 inches deeper than the container, but in no case shall depth be less than 16 inches below finished grade. Side of excavation shall be substantially vertical and the bottom shall be parallel to finished grade.

Tree pits shall have substantially vertical sides and horizontal bottoms. Depth of pit below finish grade shall be at least 6 inches greater than the depth of the ball. In no case shall depth of tree pits be less than 24 inches below finished grade. Diameter of pits for all trees shall be at least 12 inches greater than the maximum diameter of the tree ball or root system. Install root barriers at all parking lot island plantings and any other locations shown on the plans.. Root barriers to be installed in strict conformance with manufacturer's recommendations.

C. Planting Operation

Trees and shrubs shall be supplied in sizes shown on the Landscaping Plan with all plants "Balled and Burlapped" or containerized. During planting operations, the nursery stock shall not be exposed to the sun, drying winds, or winter freezing. Roots of evergreens shall not be exposed to the air.

Planting may be executed at any time between March 1 and September 30, provided the ground is not frozen. The Contractor shall take all precautions he deems necessary against desiccation, freezing, or other potential damage to plant materials due to weather conditions existing or that may be expected at the time of planting and during the maintenance and guarantee periods.

The soil in the bottom of the hole, which has been excavated to the prescribed requirements, shall be loosened to a depth of 3 inches and mixed with an equal amount of topsoil. A mound of soil shall be formed in the center of the hole to support the ball of the plant. The plant shall be placed on the mound of soil and held in a vertical position. Handle all "Balled and Burlapped" shrubs and trees by the earth ball and not by the top, exercising care not to drop or loosen the ball. After setting the shrub or tree at proper depth, untie or cut rope at trunk of plant and loosen burlap carefully without disturbing the earth ball. The plant shall be so set, by adjusting the elevation of the mound, that after settlement the plant will stand at approximately the same depth it stood in the nursery or field.

The plant hole shall be backfilled with topsoil, peat mixture and Mag Amp placed in layers around the ball. Each layer shall be carefully tamped in place in a manner to avoid injury to the ball or disturbing the position of the plant. When approximately two-thirds of the plant hole has been backfilled, the hole shall be filled with water and the soil allowed to settle around the roots. Balled and burlapped plants shall have the burlap cut away or folded back from the top of the ball before applying the water. After the water has been absorbed, the plant hole shall be filled with topsoil and tamped lightly to grade. Any settlement shall be brought to grade with topsoil.

In the case of planting in the open on hot days, shorten the time between planting and watering.

3.3 STAKING TREES:

All trees may be guyed with three 2" x 2" fir stakes or 3/4-inch steel rebars 3 feet long driven into the ground outside the saucer. The stakes shall be equally spaced. The tree will be secured to the stakes by No. 12 gauge wire with rubber hose around the first lateral branch. The guy wires should have a maximum of 1/2 inch slack. Do not have wire taut. The exposed portion of the stake shall be painted dark green or brown. Staking is not mandatory. See detail.

3.4 MULCHING:

A. General

All beds will be cultivated following the general shape of the basins or beds as indicated on the plans. Install all weed barrier strictly in conformance with manufacturers recommendations and installation procedures. Weed barrier shall be laid on topsoil in all shrub beds following plant installation. Weed barrier shall be completely covered by mulch. Anchor weed barrier with plastic stakes provided placed 4' o.c. around edges and along splices. Lap all splices a minimum 2". No weed barrier is to be placed in beds to receive perennial or annual plants.

B. Mulching

Apply the mulch to a depth of 3", evenly spread over the entire area of each shrub bed.

3.5 PRUNING:

The brushed or broken parts of large or fleshly roots shall be cut off smooth before planting. The tops of deciduous plants shall be pruned either before or immediately after planting by removing one-third to one-half of the top by thinning out and/or heading back the stems and top branches, and shall be done so that the plant retains its natural form. Except when heading back, all cuts shall be made flush with the trunk or branch. Evergreen plants shall not be pruned except to remove dead or broken branches.

Cuts over 1/2 inch in diameter shall be painted with an approved tree paint. Paint shall cover all exposed cambium as well as other exposed living tissue. Paint shall be waterproof, adhesive and elastic, antiseptic, free from kerosene, coal tar creosote or any other material injurious to the life of the tree and shall be approved before it is used. Use Treheal as manufactured by Flintkote, or approved equal.

Trees and shrubs that have been so badly pruned as to spoil their form and usefulness shall be removed and replaced.

3.6 INSPECTION:

A. Scheduling

In addition to the normal progress inspections, schedule and conduct the following formal inspections, giving the Owner's Representative at least 48 hours prior notice of readiness for inspection.

1. Inspection of plants in containers prior to planting.

2. Inspection of plant locations, to verify compliance with the plans.

3. Substantial completion inspection after completion of planting. Schedule the substantial completion inspection sufficiently in advance, and in cooperation with the Owner's Representative so that final inspection may be conducted within 24 hours after completion of planting.

4. Final inspection at the end of the maintenance period, provided that all previous deficiencies have been corrected.

3.7 MAINTENANCE:

A. General

Maintain all planting, starting with the delivery of plant materials and continuing until completion of job. Maintenance shall include all watering, weeding, cultivating, spraying, and pruning necessary to keep the plant materials in a healthy growing condition and to keep the planted areas neat and attractive throughout the maintenance period. Provide all equipment and means for proper application of water. Protect all planted areas against damage, including erosion and trespassing, by providing and maintaining prior safeguards.

If any tree, shrub, or plant bed settles more than 1-1/2 inches below the established grade, the plant shall be raised to the proper level and not merely covered with additional mulch.

B. Replacements

At the end of the maintenance period, all plant material shall be in a healthy growing condition.

During the maintenance period, should the appearance of any plant indicate weakness and probability of dying, immediately replace the plant with a new and healthy plant of the same type and size without additional cost to the Owner.

Continue the maintenance period at no additional cost to the Owner until all previously noted deficiencies have been corrected at which time the final inspection shall be made. When final inspection is made and deficiencies are noted, the maintenance period will continue until such deficiencies are corrected at no additional cost to the Owner.

3.8 GUARANTEE:

A. Time Frame

Guarantee all plant materials to remain healthy and in a vigorous growing condition for a period of 1 year following substantial completion. The final inspection shall be one year from the date of substantial completion.

B. Replacements

All plants rejected during final inspection shall be replaced immediately by new healthy plants of equal size. All replacements shall be the same species as originally installed.

END OF SECTION 02840

SECTION 16010 - GENERAL REQUIREMENTS

GENERAL

A. SCOPE - This section applies to all Division 16 and is part of all other Division 16 sections. Provisions, terms, and requirements of General Division, Division 1, Applicable Drawings and Technical Specifications herein apply to all work under this Division. Refer to other sections of these specifications for additional requirements.

1. WORK INCLUDED - Division 16 contractor shall be responsible for all work shown on Division 16 contract documents unless specifically noted otherwise.
2. WORK EXCLUDED - Only where listed herein or specifically noted as such on drawings, in specification or in addenda may work be excluded from this contract.
3. ALTERNATES - See General Division for Schedule of Alternates. Make allowance for any changes required in scope of work due to affect of alternates and assign any difference in price to each respective alternate.

B. SPECIFICATION TERMINOLOGY - Specifications are of abbreviated or "streamlined" type and include incomplete sentences. Omissions of words or phrases such as "the Contractor shall," "in conformity with," "shall be," "as noted on the drawings," "according to the plans," "an," "the," and "all" are intentional. Omitted words or phrases shall be supplied by inference as with notes on drawings.

C. DEFINITIONS - Throughout contract documents these words and phrases are used:

1. Accessible - Arranged so that appropriately dressed man, 6'-2" tall, weighing 250 pounds, may approach area in question with tools and products necessary for work intended, and may then position himself to properly and safely perform task to be accomplished, without disassembly or damage to surrounding installation.
2. Contract documents - <u>All</u> drawings, specifications, addenda and change orders that document work to be done.
3. Contractor (used in Division 16 or on electrical drawings) - Contractor for electrical work.
4. Coordinate with General Contractor to . . . - It is assumed that electrical contractor will wish to have General Contractor do this work. Costs for all material, labor, setup, adjusting, painting, patching, coordination, etc. associated with this work shall be electrical contractor's responsibility.
5. Demolition (demo) – Carefully disconnect and remove items. All reasonable caution shall be taken to avoid damaging demo'ed equipment and to retain its operability.
6. Demo back to source - Remove all conduit and wire back to panelboard or last live device.
7. Equivalent or equal - Product of like type and function that complies with all applicable provisions of drawings and specifications and which has been approved as substitute for specified item.
8. Furnish - Purchase material as shown and specified, and cart material to approved location on site or elsewhere as noted or agreed.
9. Install - Set in place and connect, ready for use and in complete and properly operating finished condition.
10. Product - Generic term that includes materials, equipment, fixtures and any physical item used.
11. Provide - Furnish all products, labor, sub-contracts, and appurtenances required to install complete and properly operating, finished condition.
12. Rough-in - Provide conduit raceway system with junction boxes, fittings, straps, etc., for future installation of wiring, devices, disconnects and breakers. Provision shall be made in panelboard (hardware, etc.) for future installation of breakers.
13. Serviceable - Arranged so that component or product in question may be properly removed and replaced without disassembly, destruction or damage to surrounding installation.

D. INTENT OF SPECIFICATIONS AND DRAWINGS

1. Plans and specifications are intended to result in complete electrical installation in full compliance with all applicable codes and ordinances.
2. Plans and specifications are to supplement each other and any details contained in one shall be included as if contained in both.
3. Electrical drawings shall serve as working drawings, but Landscaping drawings shall take precedence if any dimensional discrepancies exist.
4. Drawings are partly diagrammatic and do not show exact routing of conduits, exact location of products, or installation features in minute detail. Locations of devices, fixtures and equipment are approximate unless dimensioned.
5. Riser diagrams and control schematics are not to scale and do not show physical arrangement of equipment. Do not use riser diagrams or schematics to obtain lineal conduit and cabling distances.
6. Items are shown on drawings in locations to minimize interference with other equipment, structural members, etc. Exact finish locations are not indicated, however, and all work shall be done to avoid interference, preserve headroom and keep openings and passageways clear.
7. In event that discrepancies of any kind exist or required items/details have been omitted, Contractor shall notify Architect/Engineer in writing of such discrepancy or omission at least ten days prior to bid date. Failure to do so shall be construed as willingness of Contractor to supply all necessary materials and labor required for proper completion of work.

E. CONTRACTOR'S RESPONSIBILITY - Contractor shall be responsible for installation of complete and functional piece of work in accordance with true intent of contract documents. Provide all incidental items required for complete installation and satisfactory operation of all equipment, whether or not specifically noted in contract documents.

1. QUALIFICATIONS
   a. Contractor shall employ on this project, capable, experienced and reliable foreman and such skilled workmen as may be required for various classes of work to be performed.
   b. Where special skills and certification are required, Contractor shall ensure that work is performed by individuals with required experience, skill and certification.
   c. If, in Engineer's opinion, Contractor's employees do not possess necessary qualifications to perform specialty work, Contractor will be required to obtain services of workmen who are approved by manufacturer and certified by applicable agency or group. These workmen, if required, shall be provided at no additional expense.
   d. Refer to other specification sections for additional required contractor qualifications and certification.
2. LICENSING AND CERTIFICATION - All Division 16 work shall be accomplished by Electricians, licensed by state in which work is being done, certified as required, and skilled in their craft.
3. COORDINATION
   a. Contractor shall consult <u>all</u> contract documents, shop drawings of other trades to predetermine that his work and equipment will fit as planned. Do not scale drawings for fabrication. No extra payment will be issued for materials or items which do not fit because of Contractor's failure to verify dimensions in field.
   b. Changes in location of electrical work, necessary due to obstacles or installation of other trades shown on contract documents, shall be made by Electrical Contractor at no extra cost.

c. Lay out all work in advance and avoid conflict with other work in progress. Verify locations for junction boxes, disconnect switches, stub-ups, etc., for connection to equipment furnished by others, or in other Divisions of this work.
d. Contractor shall coordinate and plan work to proceed with work of other trades.
e. Contractor shall check dimensions of all electrical equipment installed, provided by himself or by others, so correct clearances and connections can be made.
f. Consulting all contract documents and shop drawings of other trades, contractor shall determine where electrical junction/pull boxes and equipment can be installed to maintain proper accessibility. Report any conflicts to Architect/Engineer.

F. LOCAL SITE CONDITIONS

1. All equipment, hardware and systems shall properly operate and deliver specified output ratings under following conditions:
   a. Elevation of 4100 feet.
   b. Relative humidity of up to 95%.
   c. Ambient temperatures as follows:

Environment	Degrees F	Degrees C
Exterior	-40 to 113	-40 to 45

   Equipment shall be designed for these parameters or shall be oversized sufficiently to ensure normal longevity without undo degradation.
2. All equipment and raceways shall be properly supported as required for Seismic Design Category C.
3. All exterior light fixtures and electrical equipment shall be designed to withstand constant wind loads of 100 mph with gusts up to 130 mph.

G. CODES, STANDARDS AND REGULATIONS

1. Codes - Perform all work in strict accordance with all applicable national, state and local codes; including, but not limited to latest legally enacted editions of following codes:
   a. NFPA 70, National Electric Code – NEC (2005 edition)
   b. ANSI-C2, National Electrical Safety Code – NESC
   c. International Building Code – IBC
   d. Uniform Fire Code – UFC
2. Standards - Reference to standards infers that installation, equipment and material shall be within limits for which it was designed, tested and approved, in conformance with current publications and standards of following organizations:
   a. American National Standards Institute – ANSI
   b. American Society for Testing and Materials – ASTM
   c. Institute of Electrical and Electronics Engineers – IEEE
   d. Insulated Cable Engineers Association – ICEA
   e. National Electrical Contractors Association – NECA
   f. National Electrical Manufacturers' Association – NEMA
   g. National Fire Protection Association – NFPA
   h. Underwriters' Laboratories, Inc. – UL
3. Regulations - Design has been performed in accordance with applicable regulations and guidelines noted below. Contractor shall carefully apply these regulations and bring any discrepancies to immediate attention of Architect/Engineer.
   a. Americans with Disabilities Act – ADA

H. PERMITS AND INSPECTIONS

1. Division 16 Contractor shall pay for all permits or fees in connection with electrical work. Fees shall include any or all user fees, government fees, system development fees, connection fees or other fees that are required to be paid before systems can be connected or used.

2. Schedule all required electrical inspections with local electrical inspector. Notify engineer of all items of discrepancy noted by electrical inspector if those items affect cost or function of system, or if they conflict with electrical drawings and specifications.
3. Deliver all inspection certificates to Architect/Engineer prior to final acceptance of work.

I. RECORD DOCUMENTS (AS-BUILT DRAWINGS)
1. See requirements regarding record documents in General Division and Division 1.
2. At beginning of work, Contractor shall set aside one complete set of drawings which shall be maintained as complete "As-Built" set. Drawings shall be updated daily in neat and legible manner and shall not be used for any other purpose. Drawings and shall be maintained at job site and available for review at any time.
3. Show dimensioned location and routing of all electrical work that will become permanently concealed or buried underground.
4. Show complete routing and sizing of any significant revisions to systems shown.
5. Show provisions for future connection, referenced to building lines or approved bench marks.
6. At completion of project, deliver drawings to Engineer for review.

J. GUARANTEE - WARRANTY
1. Contractor shall and hereby does warrant and guarantee that all work executed under this Contract shall be free from defects in materials and workmanship for period of one year. Contractor further agrees that he will, at his own expense, repair and/or replace all such defective materials and all other material damaged thereby, which becomes defective during term of warranty. Exceptions include any other specific warranties, of duration greater than one year, as called out in other sections of specification, shall be honored for that period of time specified.
2. All warranty periods shall run from date of substantial completion, unless specifically noted otherwise.

PRODUCTS

A. GENERAL - Throughout construction documents various materials, equipment, apparatus, etc., are specified by manufacturer, brand name, type or catalog number. Such designations are to establish standards of desired quality and construction and shall be basis of bid.

B. SUBSTITUTION OF MATERIALS - Where substituted equipment requires structural, architectural, mechanical, plumbing or electrical work that differs from basic design, cost of all changes, including re-design, shall be responsibility of contractor using substitution.
1. APPROVED MANUFACTURERS
a. In general, one particular manufacturer and part number or series is listed to describe equipment. Equivalent equipment of other manufacturers listed for that item may be substituted without prior approval. It shall be Contractor's responsibility to ensure that item used for bidding purposes is truly equivalent to that specified. If it is not equivalent, it will be rejected at shop drawing review and Contractor shall supply specified item at his own cost.
b. It is understood that manufacturers listed may not actually have equivalent product to that specified. If contractor/distributor has any questions regarding desired product characteristics and suitability of proposed substitution, he is encouraged to submit for prior approval. Also, any manufacturer not listed shall be submitted for prior approval.
2. PRIOR APPROVALS
a. Manufacturers not listed in specification or on schedule for a particular item are open for substitution prior to bid opening only.
b. Manufacturers desiring approval shall submit catalog cuts that define quality of product and ability to perform as specified. It is understood that no two manufactures use identical methods or make identical products. Any and all deviations from that specified shall be clearly noted.

c. Submittals shall arrive at Engineer at least ten (10) days prior to bid opening. All approvals will be listed in last addendum as being approved to bid. Items substituted, but not listed in contract documents, will not be considered if submitted on shop drawings.

d. Approval of substitute equipment is on basis of quality only. Materials supplier shall be responsible for his quotation reflecting proper selection of his particular equipment with regard to proper capacities, physical dimensions, requirements, intended function, finish, color, etc. Engineer will not give approval to specific model numbers or check capacities, dimensions, or requirements. Evaluation will be on basis of quality and equality to specified items.

e. Prior approval shall be obtained from engineer and no other entity (architect, owner, etc.) is authorized to give such approval.

3. SAMPLES

a. Where, in Engineer/Architect's opinion, product sample is required in order to determine appearance, quality, workmanship or operation, Contractor shall submit actual production samples of item in question.

b. Samples will be returned to Contractor. Approved samples may be used.

c. All costs incurred in providing and returning samples will be Contractor's responsibility.

C. PRODUCT AND SYSTEM SUBMITTALS

1. GENERAL REQUIREMENTS

a. See General Division, "Submittal of Information."

b. Submit shop drawings no later than 30 days after award of contract allowing sufficient time for review without delaying construction.

c. Provide minimum six (6) sets submittal packages for products and systems described in Schedule of Submittals.

d. Shop drawings submitted via e-mail will not be accepted. Advance copies of critical time-line items may be submitted via e-mail, but these shall be followed up with printed sets routed through normal channels.

e. Shop drawings shall be for actual equipment and hardware that will be installed. Bill of materials may be attached, but part numbers shall be clearly indicated on cut-sheets. Submittals that include more than one manufacturer or part number for specified item will be rejected.

f. Mark submittal literature and shop drawings clearly and bind 8.5" x 11" literature in three-hole loose-leaf binders by individual sets.

g. All submittals shall be accompanied by transmittal letter indicating date, project name, contractor's name and address, product description/type, and deviations from contract documents if any.

h. Submittals that are not in strict compliance with these standards will be rejected.

2. SCHEDULE OF SUBMITTALS

SECTION – ITEM	A	B	C	D	E	F	G
16140 – Wiring Devices		B		D	E		
16420 – Service Entrance Equipment				D	E	F	G
16440 – Disconnect Switches				D	E		
16450 – Grounding Devices				D	E	F	
16460 – Transformers				D	E	F	G
16470 – Panelboards				D	E	F	G
16475 – Overcurrent Protective Devices				D	E		G
16510 – Light Fixtures, Accessories and Hardware	A	B	C	D	E		G

A - Prior Approvals - Provide under timetable and conditions listed above.

B - Color Selection - Provide under timetable listed below for shop drawings.

C - Production Model Samples - Provide under timetable listed below for shop drawings. (Contact Engineer for specific items requiring samples).

D - Shop Drawings - Provide under timetable listed below.
E - Manufacturer's Recommendations for Installation, Setup and Use - Provide under timetable listed below for shop drawings.
F - Test Reports - Provide as required elsewhere in this specification.
G - Operation and Maintenance Instructions - Provide as part of Brochure of Equipment.
Note that information in columns D, E, F & G shall be included in Brochure of Equipment.

3. CONTENTS - Include data for review and organize as follows:
   a. Specification reference and/or drawing reference for which literature is submitted with index, following specification format.
   b. Equipment manufacturer's name and address, and supplier's name, address and phone number.
   c. Catalog designation or model number.
   d. Equipment voltage, phase and expected current draw/watt usage.
   e. Rough-in data and dimensions.
   f. Operation characteristics.
   g. Complete customized listing of characteristics required. Indicate any deviations on submittal. Mark out all non-applicable items. Terminology "As Specified" used without this customized listing is not acceptable.
   h. Wiring diagrams for specific system.
   i. Working construction drawings (shop drawings).
   j. Color charts for selection of standard factory finishes, or special finishes as indicated for each item.
   k. Installer's qualifications as required.
   l. Warranty information.
4. SUBSTITUTED EQUIPMENT
   a. Shop drawings on substituted equipment shall include required project drawings and engineering changes that are necessary to implement installation of substituted equipment.
   b. Submittals shall be marked to indicate compliance with each requirement as listed in specification by paragraph number. Differences from specified requirements shall be clearly noted.
5. COORDINATION AND REVIEW
   a. Prior to submission of shop drawings, hold meeting with all trades and check shop drawings for discrepancies, dimensional errors, omissions, contradictions and departures from contract requirements. Shop drawings shall then be corrected and submitted with appropriate notes. Submittal of shop drawings which affect other trades indicates that coordination has been done and that all parties are in agreement as to who provides, installs and connects various hardware and equipment.
   b. **Contractor shall approve and sign all shop drawings prior to submitting for review.** Drawings received without Contractor's note of approval will be returned without review. This required approval is in addition to any notation General Contractor may apply to shop drawings.
6. PARTIAL SUBMITTALS - Partial submittals will be considered for review provided they are complete sections.
7. ENGINEER'S REVIEW - Submittal review is for general design and arrangement only and does not relieve Contractor from any requirements of contract documents. Submittals will not be checked for quantity, dimension, fit or proper technical design of manufactured equipment. Where product or system performance deviations have not been specifically noted in submittal by Contractor, Engineer's review will not relieve Contractor's responsibility to provide complete and satisfactory working installation of equal quality and performance to specified system. Ordering, manufacture, shipment or

installation of equipment prior to receipt of Engineer's written review is strictly at Contractor's risk and all costs associated with shipping, changes, replacement or restocking shall be Contractor's responsibility.

8. RESUBMITTED ITEMS - Contractor shall determine what needs to be resubmitted by carefully examining Engineer's review sheet attached to returned submittals. Only items noted as "NOT ACCEPTED" should be resubmitted. If for any reason "REVIEWED" equipment is resubmitted do to changes, it shall be clearly marked as such. Without specific marking alerting Engineer to changes, Contractor will be expected to provide that which was originally submitted and reviewed.

F. BROCHURE OF EQUIPMENT

1. GENERAL
   a. Upon completion of Contract, Contractor shall prepare two (2) copies minimum of "Brochure of Equipment" containing data pertinent to equipment and systems. Binders containing material shall be of three ring binder type (spiral-type binders are not acceptable) of sufficient number to hold all literature. Provide tab for each chapter.
   b. Provide separate chapter for each section of electrical specifications with sub-chapters for each class of equipment or system. Provide table of contents for each chapter, and each major item in each chapter, to indicate page number of each. Label all pages to assure correct placement in manual. Identify each piece of equipment with its associated specification description.
   c. Submit one copy of brochure to Engineer for approval prior to preparation of final copies. Final copies shall incorporate any changes or additions deemed necessary by Engineer and shall include his letter of approval. After approval, final copies of brochure shall be turned over to Owner. This shall take place prior to authorization of final payment.
2. CONTENTS – Each chapter shall include following items as applicable:
   a. Warranties and maintenance agreements with dates, duration and responsible parties.
   b. Names, addresses and phone numbers for manufacturer, distributor and qualified service agency.
   c. Complete narrative of how system is intended to operate.
   d. Copy of all corrected, approved shop drawings for project either with manufacturers' brochures or properly identified in separate subsection.
   e. Wiring diagrams and control sequences.
   f. Manufacturer's descriptive literature covering all products used in each system including:
      1 Illustrations
      2 Exploded views
      3 Renewal parts lists
      4 Control system schematics
      5 Applicable service bulletins

      Highlight all applicable items and instructions, or mark-out non-applicable items.
   g. Operation sequences and troubleshooting information
   h. Maintenance instructions:
      1 Provide complete information for preventive maintenance for each product, including recommended frequency of performance for each preventive maintenance task.
      2 Provide instructions for minor repair or adjustments required for preventive maintenance routines, limited to repairs and adjustments which may be performed without special tools or test equipment and which require no extensive special training or skills.

3 Provide all information of maintenance nature covering warranty items, etc., which have not been discussed in manufacturer's literature or operating sequence narrative.

4 Provide complete information data for all spare and replacement parts for each product and system. Properly identify each part by part number and manufacturer.

i. Field testing procedures and reports as required.

3. REVIEW - Contractor shall review brochure of equipment and ask, "Will owner's maintenance personnel have what they need in this brochure of equipment to quickly find appropriate information and remedy equipment problem?" If this cannot be answered affirmatively, brochure of equipment is not adequate and needs to be revised prior to submittal.

EXECUTION

A. SITE EXAMINATION

1. Prior to submitting bid, Contractor shall visit site of proposed work and familiarize himself with conditions affecting work. Allowance shall be made in bid for these conditions and no additional allowance shall be granted because of lack of knowledge of such conditions.
2. Contractor shall verify all measurements at construction site.

B. CLEAN-UP AND COMMISSIONING

1. DURING CONSTRUCTION - Throughout construction, keep work area reasonably neat and orderly by periodic clean-ups.
2. COMMISSIONING - As independent parts of construction are completed, they may be commissioned and utilized during construction. See various sections for restrictions.
3. AT COMPLETION OF WORK
   a. Clean equipment of dirt and debris, including interior of panels, outlet boxes, etc. Remove labels from and clean all fixture lenses.
   b. Remove materials, scraps, etc., relative to this work and leave premises in clean and orderly condition.
   c. Remove all temporary facilities and restore to conditions present prior to work.

C. PROJECT COMPLETION AND DEMONSTRATION

1. TESTING
   a. Prior to final test, all switches, panelboards, devices, and fixtures shall be in place.
   b. At completion of work, or upon request from Architect/Engineer, place entire electrical installation, and/or any portion thereof, in operation to demonstrate satisfactory operation.
   c. All electrical systems shall be free from short circuits and unintentional grounds.
   d. Furnish one (1) copy of certified test results to Architect/Engineer prior to final inspection and include one (1) copy in each Brochure of Equipment.
2. ADJUSTMENTS
   a. Make all changes necessary to balance connected electrical loads on complete system. Arrange for balanced conditions of circuits under connected load demands, as contemplated by normal working conditions. Final load and balance test shall be demonstrated in presence of Architect/Engineer.
   b. Immediately correct all deficiencies which are evidenced during tests and repeat tests until system is approved. Do not cover or conceal electrical installations until satisfactory tests are made and approved.
3. FINAL WALK-THRU
   a. Conduct operating tests during final inspection. Demonstrate installation to operate satisfactorily in accordance with requirements of Contract Documents. Should any portion of installation fail to meet requirements of Contract

Documents, repair or replace items failing to meet requirements until items can be demonstrated to comply.

b. Have instruments available for measuring light intensities, voltage and current values and for demonstration of continuity, grounds, or open circuit conditions.

c. Furnish personnel to assist in taking measurements and making tests. In event that systems are not complete and fully operational at time of final inspection, all costs of any subsequent inspections shall be borne by Contractor at no additional cost to Owner.

D. OWNER ORIENTATION AND TRAINING

1. Contractor shall instruct Owner as to function, operation, maintenance and adjustment of each piece of equipment and system provided. Contractor shall set aside at least one day for this instruction at which Owner or Owner's representative (preferably person who will be maintaining each particular system) shall be present.

2. Contractor shall provide Owner with two copies of Brochure of Equipment as called for in specifications. Brochure shall be used during instruction period to familiarize Owner with its contents.

END OF SECTION 16010

SECTION 16020 - SITE WORK

GENERAL

A. DESCRIPTION - This section describes general requirements and methods of execution relating to site work on this project.

B. RELATED WORK

1. All work performed under this section shall be subject to requirements in General Division, Division 1 and Division 16. It shall be performed in accordance with contract drawings and manufacturer's guidelines.
2. Contractor shall thoroughly examine following sections which contain related work:
   a. Section 16110 - Conduit and Fittings
   b. Section 16120 - Wire and Cable
   c. Section 16420 - Service Entrance

C. SUBMITTALS - Provide shop drawing submittals in accordance with Section 16010.

D. RECORD DRAWINGS – Contractor shall mark up as-built drawings showing all buried items dimensioned from permanent building points.

PRODUCTS

A. GENERAL - Products and equipment required in this section shall be as specified in other portions of this specification.

B. CONDUIT

1. Buried conduits may be rigid metallic conduit (coated with bitumastic or two layers of 10 mil. corrosion protection tape) or PVC.
2. Elbows used to turn buried conduits in horizontal plane shall be rigid metallic (coated with two coats of bitumastic or two layers of 10 mil. corrosion protection tape).
3. **Conduit and elbows extending above ground shall be rigid metallic, coated with two coats of bitumastic or two layers of 10 mil. corrosion protection tape and properly supported.** Only where specifically required by serving utility, may PVC conduit extend above ground. Where serving utility does specifically require exposed PVC, Schedule 80 PVC shall be used to protect from exposure to sunlight.

C. UNDERGROUND ENCLOSURES – Enclosures shall be sized to exceed minimum wire bend radius requirements (NEC Article 300) and to comply with maximum box fill requirements (NEC Article 370).

1. Enclosures shall be made of polymer concrete with minimum 20,000 P.S.I. compressive test strength.
2. Enclosures shall be suitable for installation and use through temperature range of minus 40 to plus 90 degrees C.
3. Enclosures shall be rated for 10,000 pound vertical load where installed in non-traffic areas and shall be rated for 20,000 pound vertical load where occasional vehicle loads may occur.
4. Enclosures shall include venting to avoid potential build-up of methane gas.
5. Enclosures shall have duct terminators, properly sized to accommodate conduits.
6. Covers shall have skid resistant surface with minimum 0.50 coefficient of friction.
7. Covers shall be held down with penta-head bolts.
8. Covers shall have pockets for manhole lift hooks.

D. WARNING STRIP - 3" wide, 4 mil. non-adhesive polyethylene strip by L.H. Dottie, Klein, Blackburn, Griffolyn or equivalent.

Buried Line	Color	Legend	Dottie Cat. No.
Power (480V or less)	Red	Caution Buried Electrical Line Below	UT-8D
High Voltage Power	Yellow	Caution Buried High Voltage Line Below	UT-11D

EXECUTION

A. GENERAL - Whether he does it himself or arranges for others to do it, Electrical contractor shall be responsible for all excavation and backfill for electrical systems.

B. BURIAL DEPTHS - Minimum depths shall be as listed below. Depths shall be increased as required to comply with service utilities requirements, NEC Article 300-5 and any local ordinances or codes.

Buried Line	Min. Depth General	Min. Depth where Trench is Shared with Irrigation Control
Power (480V or less)	24"	30"

C. DUCT/SLEEVES UNDER ROADWAYS - Conduit shall be installed in galvanized rigid steel duct/sleeve where installed under all paved roadways or driveways, or in other locations as noted on drawings.

1. Steel duct diameter shall be sized to allow conduit with couplings to be easily slid in and out of duct.
2. Steel duct shall extend 5'-0" beyond paving on each side of roadway.
3. Duct location shall be marked with (2) 2" diameter aluminum duct markers centered over duct and each located 12" inside pavement edge.

D. EXCAVATION AND BEDDING

1. Excavation in rocky areas where excavated material contains rocks greater than 2" in diameter shall require removal of material 12" deeper than desired trench depth. Bottom of trench shall then be filled to desired depth using material and compaction as specified herein.
2. All conduit laid in trenches shall be bedded evenly and firmly. Trench bed shall consist of undisturbed native soil. Where firm bedding is not obtainable or trench is dug deeper because of rocky conditions, compacted sand or gravel fill, or low strength concrete fill shall be used for bedding.
3. Where garbage is encountered, area shall be over-excavated and treated in accordance with details on plans.

E. CONDUIT INSTALLATION - See Section 16110 - Conduit and Fittings for additional requirements.

F. UNDERGROUND ENCLOSURES

1. LOCATIONS
   a. BURIED POWER CONDUITS - Pull boxes shall be installed to ensure that there are no more than four quarter bends (360 degrees total), or distance of 400 feet between pull points.
   b. Additional pull boxes shall be installed as required to minimize conflicts with paving and as required by cable manufacturer's guidelines.
2. INSTALLATION
   a. Excavate to allow 12" bedding material beneath enclosure.
   b. Install compacted gravel or crushed rock bedding to allow level enclosure installation.
   c. Place cover on enclosure and backfill uniformly on all four sides. Backfill to grade level and compact to 95% density. Ensure that cover is flush with grade.
   d. Include venting to avoid potential build-up of methane gas.
   e. Turn over (2) penta-head sockets to Owner.

G. BACKFILL

1. Architect/Engineer shall inspect all buried services prior to backfill. Contractor shall notify Architect/Engineer when this phase of work will be ready for inspection at least 48 hours prior to beginning backfill.
2. Backfill material shall not contain rocks larger than 2" in diameter. Excavated material in rocky areas which contains rocks larger than 2" in diameter shall be removed from construction site and replaced with fill materials meeting requirements specified herein.

3. All backfill shall be compacted to Architectural Specifications in not more than 12" layers to prevent settling.
4. Backfill shall be neither excessively wet or dry. Puddling or flooding shall not be used except in sand or gravel bearing soil, and as specifically approved.
5. Backfill trench simultaneously on both sides of conduit to prevent displacement.

H. COMPACTION - Compact backfill from trench bottom up to conduit centerline and all backfill within building outlines, drives and parking areas to 95% density as determined by ASTM D1557. Compact all other backfill material to density of at least 85% of adjoining undisturbed earth with backfill at suitable elevation above grade for anticipated settlement or shrinkage.

I. PAVING REPAIR - Paving taken up or damaged in work of this Contractor shall be replaced to match existing. All work shall meet Architectural/Structural specifications and shall be in strict accordance with local regulations, ordinances, practices, and done to full satisfaction of jurisdictional authority.

J. CONCRETE REPAIR - Concrete taken up, damaged or cut during this work shall be replaced to match existing. All work shall meet Architectural/Structural specifications. Provide reinforcing, expansion joints, surface finish, etc., as required along with proper base, compaction, etc.

K. WARNING STRIP - Install warning strip directly above buried conduits, at 12" below final grade.

END OF SECTION 16020

SECTION 16050 - ELECTRICAL IDENTIFICATION

GENERAL

A. EQUIPMENT LABELS AND NAMEPLATES - Provide rigid engraved labels and nameplates of laminated plastic 1/16" thick.
   1. Labels shall have white letters and shall have black background color.
   2. Securely attach all labels with two screws, minimum, per label. Adhesives or glue are not acceptable.
   3. Temporary markings not permitted on equipment. Repaint trims, housings, etc., where temporary markings cannot be readily removed.
   4. No labeling abbreviations will be permitted without prior approval.

B. LABEL SIZES AND NAMEPLATE LOCATIONS
   1. Provide 1/2" minimum height letters on:
      a. Secondary feeder breakers in distribution equipment. Designation as required by load served.
      b. Contactor, relay and control panels and other special equipment housed in cabinets, as designated on plans, on outside of door.
      c. Panelboards, switchboards, motor control centers, as designated on plans, on outside of door.
   2. Provide 1/4" minimum height letters on:
      a. Disconnects and starters for motors or fixed appliances.
      b. Designated electrical equipment.

C. PANELBOARDS - Label panelboards as follows:
   1. First line shall be panelboard name.
   2. Second line shall be voltage and phase.

PANEL A 120/208V, 3PH, 4W

D. PANELBOARD BRANCH CIRCUIT DIRECTORIES – For all new panelboards, and all existing panelboards modified by this work, provide updated circuit directory.
   1. Include date when directory is prepared.
   2. Directory card shall provide at least 1/8" high by 3" long space for each circuit.
   3. List odd numbered circuits on left side or top and even circuits on right side or bottom.
   4. Directory shall be typed, except that spares shall be handwritten with pencil.
   5. Define accurately nature of connected load for each circuit.
   6. DIRECTORY HOLDER
      a. All circuit directories shall be housed in plastic jacket or protective cover to protect it from damage and to allow easy removal for future revisions.
      b. Securely mount directory holder on inside face of panelboard door at roughly eye-level.
      c. Circuit directories pasted or taped to door are not acceptable.

E. EQUIPMENT LABELS – Label disconnect switches and starters as follows:
   1. First line shall be equipment designation.
   2. Second line "FED FROM".
   3. Third line shall be circuit.

HV&AC-1 FED FROM MDP-2

F. FUSE LABELING - Provide laminated plastic label on interior of every fused safety switch or fused device over 5 amps. Label shall read "Replace with LPJ-400SP fuses only" or as appropriate for size and type of fuse as specified or installed.

G. CONTACTOR ENCLOSURE DIRECTORIES – Inside cover of contactor enclosure provide following information:
   1. Typed circuit directory in clear plastic holder as noted above for panelboards.
   2. Schematic diagram for contactor control.
   3. Plan view drawings showing location of loads controlled.

H. WIRE COLOR CODE LABEL – Install permanent sticker label in each panelboard/ switchboard/loadcenter with color coding scheme for wires showing colors for phases, neutrals and grounds. See Section 16120.

I. EMPTY CONDUITS - Provide tags with typed description of purpose, and location of opposite end, wired to each end of conduits provided for future equipment.

END OF SECTION 16050

SECTION 16105 - GENERAL MATERIALS

GENERAL

A. DESCRIPTION - This section describes specific requirements, products, and methods of execution which are typical throughout electrical work of this project. Additional requirements for specific systems may modify these requirements.

B. SERVICEABILITY OF PRODUCTS
   1. Furnish all products to provide proper orientation of serviceable components to access space provided.
   2. Coordinate installation of panels, equipment, system components, and other products to allow proper service areas for all items requiring periodic maintenance inspection or replacement.
   3. Replace or relocate all products incorrectly ordered or installed.

C. ACCESSIBILITY OF PRODUCTS - Arrange all work to provide access to all serviceable and/or operable products. Layout work to optimize net usable access space within confines of space available. Advise Architect/Engineer, in timely manner, of areas where proper access cannot be maintained. Furnish layout drawings to verify this claim, if requested.

PRODUCTS

A. MATERIALS AND EQUIPMENT FURNISHED IN DIVISION 16
   1. All materials furnished and installed in permanent construction shall be new, full-weight, standard in every way, and in first class condition.
   2. All materials shall conform with standards of Underwriters Laboratories or other organization acceptable to authority having jurisdiction and concerned with product evaluation, that maintains periodic inspection of labeled equipment or materials and by whose labeling manufacturer indicates compliance with appropriate standards or performance in specified manner. Only materials designed for purpose employed shall be used. Custom-designed items shall be fabricated of UL approved materials.
   3. Materials shall be identical with apparatus or equipment which has been in successful operation for at least two years. All materials of similar class or service shall be of one manufacturer.
   4. Capacities, sizes, and dimensions given are minimum unless otherwise indicated. All systems, materials and equipment proposed for use on this project shall be subject to review for adequacy and compliance with contract documents.

B. MATERIALS AND EQUIPMENT FURNISHED IN OTHER DIVISIONS
   1. Unless otherwise noted (as on Schedule of Control Equipment), controls, including conduit, wiring, and control devices required for operation of systems in other divisions of specifications will be furnished under division in which equipment is specified.
   2. All work on project that falls under jurisdiction of electrical trade shall be performed by Licensed Electricians (licensed by state in which work is being done) in conformance with electrical specifications and in compliance with NEC.
   3. Provide complete power connections to equipment including but not limited to feeders, connections, disconnects and motor running overcurrent protection. Where starters are provided as part of packaged equipment, overcurrent heaters shall be provided or adjusted by Electrical Contractor.

C. OWNER FURNISHED EQUIPMENT AND MATERIALS - Contractor shall accept and become responsible for all owner furnished equipment and materials. Inspect all equipment and materials to determine suitability for installation. Immediately notify Owner of any defects or deficiencies. Failure to so notify Owner shall indicate Contractor warrants that all equipment and materials are of proper quantity, design and are free from all defects.

D. MANUFACTURER'S DIRECTIONS - All equipment and material shall be applied, installed, connected, erected, used, cleaned and conditioned in strict accordance with manufacturer's

recommendations. Manufacturer's installation instructions shall supersede requirements of contract documents when conflict arises. Bring such situation to Engineer's attention.

EXECUTION

A. STORAGE AND HANDLING - All items shall be delivered and stored in original containers, which shall indicate manufacturer's name, brand, and identifying number. Items subject to moisture and/or thermal damage shall be stored in dry, heated place. All items shall be covered and protected against dirt, water, chemical and/or mechanical damage.

B. PROTECTION OF MATERIALS AND EQUIPMENT - Contractor shall be held responsible for any and all materials and equipment to be installed under this contract. Risk of loss of all stored materials remains with Contractor. Owner will not pay for damaged or lost materials stored on job site. Contractor will be required to make good at his own cost any injury or damage which said materials or equipment may sustain from any source or cause whatsoever before final acceptance.

C. INSTALLATION

1. All materials and equipment shall be installed by skilled craftsmen. Norms for execution of work shall be NEC Chapter 3 and National Electrical Contractors' Association (NECA) "Standards of Installation", which herewith are made part of these specifications.
2. Repair all surfaces and furnish all required material and labor to maintain fireproof, airtight and waterproof characteristics of construction.
3. Installation of all equipment shall be in accordance with manufacturers' instructions.

D. MOUNTING HEIGHTS – Ass called out on drawings.

E. PROTECTIVE FINISHES

1. Take care not to scratch or deface factory finish of electrical apparatus and devices. Repaint all marred or scratched surfaces.
2. Provide hot dip galvanized components for ferrous materials exposed to weather.

END OF SECTION 16105

SECTION 16110 - CONDUIT AND FITTINGS

GENERAL

A. DESCRIPTION - This section describes specific requirements, products, and methods of execution relating to conduit and conduit fittings. Type, size and installation methods shall be as shown on drawings, required by code and specified herein.

B. QUALITY ASSURANCE - Conduit and conduit fittings shall be standard types and sizes as manufactured by nationally recognized manufacturer of this type of materials and shall be in conformity with applicable standards and UL listings.

PRODUCTS

A. CONDUIT - Where installed using methods specified and in locations specified in this section, following conduit types are approved:

1. Rigid Metal Conduit - RMC (NEC Article 344)
2. Liquidtight Flexible Metal Conduit - LFMC (NEC Article 350)
3. Rigid Nonmetallic Conduit - RNC – also [PVC] (NEC Article 352)

B. FITTINGS - Fittings and installation methods shall be rated for and comply with requirements for location in which they are installed.

1. RMC - Couplings and connectors shall be threaded, galvanized steel. Threadless couplings or connectors (compression type or set screw type) shall not be used, and split couplings shall not be used. Where conduits cannot be turned, 3-piece couplings (Erickson type) shall be utilized, except in hazardous areas where UNY or UNF unions shall be used. Conduit bushings shall be insulated. Where grounding bushings are required, insulated grounding bushings with pressure type lugs shall be provided.
2. LFMC - Connectors shall be steel incorporating threaded grounding cone, nylon or plastic compression ring, and tightening gland to provide low resistance ground connection.

C. BENDING RADII AND ELBOWS - Minimum radius for conduit bends and elbows shall be as follows:

	Minimum Bend/Elbow Radius	
Conduit Size	Power Conduits	Communications Conduits
1/2"	4"	6"
3/4"	4.5"	9"
1"	5.75"	12"
1.25"	7.25"	15"
1.5"	8.25"	18"
2"	9.5"	24"
2.5"	10.5"	30"
3"	13"	36"
4"	16"	48"
5"	24"	60"
6"	30"	60"

EXECUTION

A. LOCATION - Conduits installed using methods noted in this section and in following locations shall be of following types:

1. Underground or encased in concrete - RMC or RNC (aluminum conduit shall not be installed in concrete).
2. Outdoors above-ground or damp locations - RMC.

B. GENERAL INSTALLATION METHODS

1. All conduit and tubing shall be cut square and reamed smooth at ends and all joints made tight. Conduit threads shall be lubricated with approved thread lubricant.

2. Flexible conduit shall have ground wire regardless of length. Ground wire in flexible conduits may be bonded to exterior of conduit. Flexible conduit shall not exceed 36" in length. Liquid-tight flexible conduit shall be used for all motor connections.
3. Each conduit shall enter and be securely connected to cabinet, junction box, pull box or outlet box by means of locknut on outside and locknut bushing on inside, or by means of liquid-tight, threaded, self-locking, cold-weld type wedge adapter. All locknuts shall be bonding type with sharp edges and shall be installed in manner that will assure locking installation. Locknuts and bushings or self- locking adapters will not be required where conduits are screwed into threaded connections. All runs of conduit shall be protected from entrance of foreign material prior to installation of conductors.
4. Conduit or tubing deformed or crushed in any way shall not be installed or used. Conduit shall be bent only with approved bender (hydraulic or hickey). Bending machines shall be used to make field bends in conduit of 1-1/4" size and larger. Torches shall not be used in making conduit bends.
5. Raceways shall be provided with expansion joints where necessary to allow for thermal expansion and contraction.

C. INSTALLATION OF PULL BOXES - Whether or not they are shown on plans, provide and install pull boxes, sized in accordance with NEC Article 314.
1. Raceways for power wires shall have pull boxes installed to ensure that there are no more than four quarter bends (360 degrees total), or distance of 150 feet between pull points.
2. Raceways for communications cables shall have pull boxes installed to ensure that there are no more than three quarter bends (270 degrees total), or distance of 100 feet between pull points.

D. UNDER-GRADE INSTALLATION METHODS
1. PVC conduit may be used only where installed underground. Rigid steel elbows required underground and rigid steel conduits shall rise exposed.
2. Two coats of bitumastic or two layers of 10 mil. corrosion protection tape shall be applied to any buried steel conduit or elbows.
3. All conduit shall have ground conductor. All conduit stubbed up out of floor and terminating inside of enclosure shall have insulating grounding bushings installed.

E. CONDUIT SIZES - Conduits shall be sized in accordance with NEC for size, type and quantity of conductors installed, unless larger conduit is indicated. Base sizes on using type THW wire for size #6 AWG or larger, and type THWN for size #8 AWG or smaller. Allow for internal ground wires in all conduits. Minimum sizes for conduits shall be 3/4".

F. PULLSTRINGS – Pullstring(s) shall be installed in all unused conduits. Pullstring shall be woven polyester fiber (Arnco Bull-Line or equivalent).

Spare Conduit		Min. Tensile Strength (pounds)	Arnco Part No.
Diameter	Maximum length between pull-boxes		
Less than 1”	Up to 100’	500	WP05
	Greater than 100’	1250	WP12
1” to 4”	Up to 200’	1250	WP12
	Greater than 200’	2500	WP25
Greater than 4”	All lengths	2500	WP25

END OF SECTION 16110

SECTION 16120 - WIRE AND CABLE

GENERAL

A. DESCRIPTION -This section describes specific requirements, products, and methods of execution relating to wire and cable, 600 volts or less.

B. QUALITY ASSURANCE - All conductors shall be sized according to American Wire Gauge (AWG). Stranding, insulation, rating and geometrical dimensions shall conform to UL and ICEA specifications. Wires and cable, for power and communications applications, shall only be installed in environments and conditions for which they are properly rated and labeled, and in accordance with requirements of NEC.

PRODUCTS

A. DIRECT BURIED CABLES – Cables may be direct burind in accordance with NEC Article 340.

B. CONDUCTORS

1. All conductors used on this project shall be copper, solid or stranded for sizes #10 and smaller, stranded for #8 and larger.
2. Aluminum conductors
   a. All wire #6 and smaller shall be copper. All wire is sized for copper. All wire #4 and larger may be aluminum, provided substituted aluminum conductor has equal or greater ampacity, equal or lesser voltage drop, approved hydraulically compressed terminations, and has increased raceway size in accordance with NEC. Aluminum is not allowed for secondary run from utility transformer/weatherhead to main distribution panel.
   b. If aluminum is intended to be substituted, submit tabulation showing each specified copper feeder, its ampacity and raceway sizing, together with proposed equivalent utilizing aluminum with its ampacity and raceway sizing, for acceptance by Engineer.

EXECUTION

A. INSTALLATION - All wires and cable shall be installed in strict accordance with manufacturer's guidelines and in accordance with NEC requirements.

1. Conduit shall be completely installed, free from obstructions, and clean before conductors are installed. Provide conductors from outlet to outlet and splice only at outlet or junction boxes. Install all conductors in single raceway at one time and leave sufficient cable at all fittings or boxes. Keep all conductors within manufacturer's allowable tension. Do not violate minimum bending radii.
2. Provide and install pull boxes as required in Section 16110.
3. Lubricants for wire pulling, if used, shall conform to UL requirements for insulation and raceway material.
4. Do not install thermoplastic insulated conductors when ambient temperature is below 0 degrees F.

B. TERMINATIONS AND SPLICING

1. No splicing or joints will be permitted in either feeder or branch circuits except at outlet or accessible junction boxes.
2. Solid wires shall be twisted together prior to application of wire nut.
3. Utilize compression type solderless connectors when making splices or taps in conductors No. 8 AWG or larger. Utilize pre-insulated connectors, 3M Company "Scotchlok" or Ideal Industries, Inc., "Super Nut" for splices and taps in conductors No. 10 AWG and smaller. Tape all splices and joints with Scotch #88 plastic tape to secure splices and provide insulation strength equal to that of conductors joined.
4. Aluminum connections and terminations shall be as follows:
   a. Where aluminum conductors, #4 and larger, are terminated, spliced or tapped, including connections to panelboards, circuit breakers and related equipment,

connectors shall be color coded, tool applied hydraulic compression type made of aluminum with wire barrels factory pre-filled with oxide inhibiting compound.

b. Installing tools and dies, of hexagonal or circumferential type made by connector manufacturer, shall be used for installation. Tooling with color coded or die/connector coding systems for inspection purposes are preferred. Where UL listing is applicable for connectors, manufacturer's recommended tooling shall be used.

c. Terminal lugs with bolting pads shall be tin-plated for low contact resistance.

d. Connectors shall meet performance requirements of UL 486 except heating or current cycling tests shall be for minimum of 500 cycles.

e. Belleville type compression washers shall be used when ambient temperatures exceed 30 degrees C.

5. Keep splices in underground junction boxes, handholes, and manholes to absolute minimum. Where splices are necessary, use resin splicing kits manufactured by 3M Company to totally encapsulate splice.

C. CONDUCTOR TERMINATION - Provide all power and control conductors that terminate on equipment or terminal strips with solderless lugs or T & B "Sta-Kon" terminals.

D. CONDUCTOR PHASE COLOR CODING

1. All service, feeder and branch circuit conductors on project secondary electrical system shall be color coded as follows:

3-PHASE WYE SYSTEM		
480/277 VOLTS	208/120 VOLTS	PHASE
Brown	Black	A
Violet	Red	B
Yellow	Blue	C
Gray	White	Neutral
Green	Green	Ground

2. Where color coded conductors are not commercially available, colored non-aging, plastic tape may be utilized.

3. Phases in panelboards and similar equipment shall be connected Phase A, B, C from left to right, top to bottom, or front to back.

E. CONDUCTOR AMPACITIES

1. Unless both equipment, panelboard and enclosures are marked otherwise, conductors shall be sized as follows: Conductors of No. 14 to No. 1 AWG shall be applied at their 60 degree C ampacities. Conductors No. 1/0 AWG and greater shall be applied at their 75 degree C ampacities.

2. Derating of conductors shall be in accordance with National Electrical Code "Notes to Tables 310-16 through 310-19." Maximum allowable load current shall be determined by trip setting of overcurrent protection.

F. VOLTAGE DROP

1. GENERAL - Maximum total voltage drop shall not exceed 2% in feeders and 3% in branch circuits for total of 5% to farthest load based on steady state design load conditions.

2. FEEDERS - Wire sizes shown on Feeder Schedule are sized based on 2% voltage drop at full-load current rating of panel.

3. BRANCH CIRCUITS - Branch circuit homerun wire sizes shown on panel schedules are calculated to allow 3% or less voltage drop. Circuit lengths shown on panel schedules are estimates of distance. Where circuit length must be increased from that estimated for unforeseen reasons, wire and conduit sizes shall be increased to limit voltage drop based on actual lengths required in field.

Type of Load	Load Current	Estimated Distance
Receptacles	16A	To farthest receptacle
Light Fixtures	Based on total VA	To first fixture via switch(es) including length of travelers
Motors	125% of nameplate FLA	To motor/equipment
Heaters	Based on total VA	To device/equipment
Miscellaneous		

G. HARMONICS - To allow for harmonic current, any shared neutral shall be at least one size greater than its respective phase conductors.

END OF SECTION 16120

SECTION 16130 - ENCLOSURES

GENERAL

A. DESCRIPTION
   1. This section describes general requirements, products and methods of execution relating to outlet, pull and junction boxes for use with wiring devices, light fixture outlets and general raceway installation.
   2. All boxes 150 cubic inches or smaller shall be sized per NEC Article 370.
   3. Pull and junction boxes larger than 150 cubic inches shall conform to UL Standard 50-1970, Cabinets and Boxes

B. RELATED WORK – Underground enclosures are covered in Section 16020 – Site Work.

C. QUALITY ASSURANCE - UL listing for intended usage shall constitute proof of acceptable quality.

PRODUCTS

A. Cast Boxes with threaded hubs and gasketed covers shall be used in following locations:
   1. Exterior locations
   2. All wet or damp locations
   3. All surface mounted interior locations below 48" above floor
   4. Where shown on drawings

B. Grounding Screw - All boxes shall have drilled and tapped hole in back or side of box with grounding screw.

C. Accessories - Box covers, extension rings, bases, hanger bars, etc., for use in connection with installation, shall be approved for use in various applications.

D. Pull and Junction Boxes shall conform to Article 370 of NEC and following requirements:
   1. Boxes exposed to rain or installed in wet locations shall be NEMA 3R or 4, as noted.
   2. Boxes installed underground shall be precast concrete.
   3. Special boxes, as noted on drawings, shall be installed in areas of specific service and/or hazards.

EXECUTION

A. Consulting all contract documents and shop drawings of other trades, contractor shall determine where electrical junction/pull boxes and equipment can be installed to maintain proper accessibility.

B. Boxes shall have only holes necessary to accommodate conduits at point of installation. All boxes shall have lugs or ears to secure covers.

C. All boxes shall be rigidly secured in position.

D. All boxes shall be installed so that covers are readily accessible and adequate working clearance is maintained after completion of installation.

E. Grounding - Each box shall be grounded with ground pigtail from ground screw to ground wire.

F. Provide and install pull boxes as required in Section 16110.

END OF SECTION 16130

SECTION 16140 - WIRING DEVICES

GENERAL

A. DESCRIPTION - This section describes general provisions, products and methods of execution relating to line voltage wiring devices.

B. QUALITY ASSURANCE - Manufacturers mentioned and catalog numbers specified are establishment of type, configuration and quality. Other manufacturers and types may be submitted for prior approval.

C. SUBMITTALS - Provide shop drawing submittals in accordance with Section 16010.

PRODUCTS

A. GENERAL - Provide wiring devices indicated. Catalog numbers shown are Leviton unless noted otherwise. Equivalent devices manufactured by Pass & Seymour, Bryant, Hubbell, Slater and G.E. are acceptable. Provide all similar devices of same manufacturer. Provide devices and device plates of color and finish specified unless otherwise noted. In general all standard devices shall be ivory color.

B. SWITCHES - Provide 20A, 120-277V rated, commercial or industrial grade, grounding type, side-wired, switches with UL listing for tungsten lamp loads or inductive loads without derating.

C. RECEPTACLES

1. Provide grounding type, commercial spec grade receptacles as follows, or as required to match equipment furnished in this or other divisions. Note that all receptacles shall have thermoplastic bodies.

Amp	Volt	Grade	Use	Color	Leviton Part No.	NEMA
20	125	Commercial	Standard	Ivory	CR20	5-20R
20	125	Commercial	GFCI	Ivory	8898-I	5-20R

2. Outlets requiring ratings and configurations different from those listed above shall be provided as shown on plans and/or required by equipment served. All duplex outlets shall be side-wired only.

3. Ground fault interrupting outlets shall have L.E.D. indicator light and shall conform to UL standard 943 (2003), Class A. Whether shown on plans or not, GFI protected receptacles shall be installed where receptacles are shown in following locations:
   a. Exterior outlets at grade level or on roof (NEC 210.8).
   b. For temporary power outlets (NEC 305.6).

B. COVERPLATES - Coverplates shall be equivalent to following:

Environment	Device	Material	Color	Manufacturer	Part Number
Exterior – Covered when NOT in use	GFI Receptacles	Aluminum	N/A	Leviton	4992 or 6196
Exterior Keyed	GFI Receptacles	Aluminum	N/A	Pass & Seymour	4600-26~

All exterior coverplates shall be sealed to wall with waterproof gasket or caulking.

EXECUTION

A. GENERAL - All receptacles and switches shall have insulated grounding pigtail, connected to ground wire and to grounding screw in back or side of box.

B. RECEPTACLES

1. All duplex receptacles shall be rated for 20A.
2. Receptacles noted as GFI may be ground fault protected via upstream GFCI receptacle or ground fault interrupt type circuit breaker in panelboard. Protected receptacles shall be labeled as such.

END OF SECTION 16140

SECTION 16420 - SERVICE ENTRANCE

GENERAL

A. GENERAL REQUIREMENTS

1. Owner will arrange with serving utility to provide permanent electrical service including all charges or fees levied by serving utility relative to this project.
2. Contractor shall be responsible to contact electrical utility to coordinate timing and logistics in order to install electrical service in timely manner.
3. Contractor shall coordinate with utility to determine installation requirements. Following sections describe work that is typically required for service entrance installation. Each situation is unique, however, and contractor shall conform with utility's standards and procedures whether outlined below or not.

B. WORK INCLUDED - Following items shall be provided and installed by electrical contractor.

1. PRIMARY - Concrete transformer pad with primary 90-degree conduit sweeps sized in accordance with utility requirements.
2. SECONDARY
   a. Underground - Trenching, backfill and conduit, sized in accordance with utility requirements, from transformer (pole or pad mounted) to meter socket or C/T enclosure.
   b. Weatherproof current transformer (C/T) enclosure. Size, type and location shall be in accordance with utility requirements.
   c. Meter socket. Contractor shall verify configuration of meter with utility.
   d. 1" conduit between C/T enclosure and meter socket.
   e. Grounding in accordance with NEC Article 250 and Section 16450 of this specification.
   f. Lightning arrestor surge suppression.
   g. Secondary conductors and conduit, sized in accordance with Feeder Schedule and/or One-line Power Riser Diagram, from C/T's to main distribution panel.

C. WORK PERFORMED BY OTHERS

Following items will be provided and installed by electrical power utility.

1. PRIMARY
   a. Underground - Trenching from high voltage distribution to pad mounted transformer.
   b. High voltage primary cabling.
   c. Pad mounted utility transformer(s).
2. SECONDARY
   a. Conductors from transformer(s) to C/T's.
   b. Current transformers.
   c. Control wires from C/T's to meter socket.
   d. Meter.

B. JOB CONDITIONS - Contractor shall refer to Section 16020 regarding site work and shall install all equipment in accordance with manufacturer's guidelines.

C. SUBMITTALS - Provide shop drawing submittals in accordance with Section 16010. Information shall include:

1. Lightning arrestor surge suppression
2. Transformer pad configuration detail from utility.

F. BROCHURE OF EQUIPMENT - Provide brochure of equipment with all operation and maintenance information in accordance with Section 16010.

PRODUCTS

A. GENERAL - Products and equipment required in this section shall be as specified in other portions of this specification.

B. LIGHTNING ARRESTOR SURGE SUPPRESSION - See Section 16690. Lighting arrestor(s) shall be as follows:

Voltage	Configuration	Manufacturer Part No.	Discharge (w/15" leads)		
			1,500A	5,000A	10,000A
277/480	3-Phase Wye	Sq. D SDSA3650 G.E. 9L15ECC001	1825V	2425V	3000V

C. WARNING STRIP - See Section 16020.

EXECUTION

A. COORDINATION

1. Coordinate exact location of transformer pad, C/T enclosure and meter with utility and Owner prior to installation.
2. Coordinate transformer pad configuration and layout with utility and coordinate fabrication of transformer pad with General Contractor.
3. Coordinate with other serving utilities as outlined above.

B. INSTALLATION

1. Work required in this section shall be performed as specified in other portions of this specification.
2. For underground services, all secondary service conductors shall be enclosed in conduit. Conduits shall be buried at 24" minimum below finished grade. Install conduit under concrete or asphalt sidewalks or driveways for primary service conductors.
3. Install warning strip at 12" above all buried service entrance conduits.
4. Mount lightning arrestor(s) on exterior of exterior mounted main disconnect switch. Where main disconnect switch/main breaker is installed inside building, lightning arrestor(s) shall be installed exterior of building via shortest possible conduit through wall.

END OF SECTION 16420

SECTION 16440 - DISCONNECT SWITCHES

GENERAL

A. DESCRIPTION - This section describes general requirements, products, and methods of execution relating to fusible and non-fusible disconnecting devices.

B. QUALITY ASSURANCE - Devices shall be of latest approved design as manufactured by nationally recognized manufacturer and in conformity with UL listings and governing NEMA standards. Product of Square D, General Electric, Siemens or Cutler-Hammer.

C. SUBMITTALS - Provide shop drawing submittals in accordance with Section 16010.

D. BROCHURE OF EQUIPMENT - Provide brochure of equipment with all operation and maintenance information in accordance with Section 16010.

PRODUCTS

A. SAFETY SWITCHES - Safety switches, fusible and non-fusible, shall conform to NEMA Standard KSI-1975 for type HD (Heavy Duty) and be UL listed.

B. Switch Interior - All switches shall have switch blades which are fully visible in OFF position when door is open. Switches shall be of dead-front construction with permanently attached arc suppressors. Lugs shall be UL listed for copper and/or aluminum cables and be front removable.

C. Switch Mechanism - Switches shall have quick-make and quick-break operating handle and mechanism which shall be integral part of box, not cover. Switches shall have defeatable dual cover interlock to prevent unauthorized opening of switch door in ON position or closing of switch mechanism with door open.

D. Locks - Switch shall be capable of being locked in OFF position with three (3) padlocks. Exterior main disconnect switch shall also be capable of being locked in ON position.

E. Enclosures - Switch enclosure shall be suitable for environment in which switch is mounted. NEMA 1 enclosure shall be code gauge, UL-98, sheet steel, treated with rust inhibiting phosphate and finished in gray, baked enamel. NEMA 3R enclosure shall have same requirements as NEMA 1 except galvanized prior to painting.

F. Rating - Ampere, voltage and horsepower ratings, as well as number of poles and presence of neutral bar shall be shown on nameplate.

G. CIRCUIT BREAKERS - Circuit breakers used in disconnects shall meet requirements specified in Section 16475 - Overcurrent Protective Devices.

H. FUSES - Fuses used in disconnects shall meet requirements specified in Section 16475 - Overcurrent Protective Devices.

EXECUTION

A. Coordinate all details pertaining to size of motor and/or equipment, location and requirements to enclosure, ratings, etc., so as to provide most suitable unit for intended purpose.

B. Provide nameplates for all disconnects. Coordinate names with mechanical equipment lists.

C. Inside each fused disconnect, install permanent label noting fuse type and maximum size.

D. Where recommended or required by equipment manufacturer, or required by UL, disconnects shall be fusible type, fused in accordance with equipment nameplate information.

END OF SECTION 16440

SECTION 16450 - GROUNDING

GENERAL

A. DESCRIPTION - This section describes general requirements, products and methods of execution relating to furnishing and installation of complete grounding system as required.

B. MINIMUM REQUIREMENTS - System shall conform to NEC Article 250, and unless specified elsewhere, ohmic values for grounds and grounding systems shall be as follows:

Item	Resistance to Ground
Man-Made Ground	10Ω Maximum
Service Entrance Ground Bar	10Ω Maximum
Exterior equipment enclosurers	5Ω Maximum

C. SUBMITTALS - Provide shop drawing submittals in accordance with Section 16010.

D. BROCHURE OF EQUIPMENT - Provide brochure of equipment with all operation and maintenance information in accordance with Section 16010. Include following:

1. Photographs of ground rod installation prior to burial.
2. Certified test results from ground resistance measurements.

PRODUCTS

A. GENERAL - All grounding conductors, ground rods, and equipment required for ground systems shall be in accordance with UL 467.

B. GROUND RODS - 3/4" copper clad steel, 10' or longer. (VFC No. 3410 or equivalent).

C. GROUNDING CONDUCTORS

1. Buried conductors between ground rods shall be bare, stranded copper sized in accordance with contract drawings.
2. Service ground conductor, including man-made ground, shall be bare copper sized in accordance with NEC Table 250-66 and Feeder Schedule on plans.
3. Equipment and wiring device grounding conductors shall be as follows:
   a. Have green insulation of type identical to circuit conductors serving loads.
   b. Be sized same as circuit conductors for wiring devices.
   c. Be sized in accordance with NEC Table 250-122 for equipment.

D. GROUND RODCONNECTIONS

1. Connections to buried conductor between ground rods shall be Cadweld or equivalent.
2. Connection to service ground conductor shall be heavy duty bronze clamp with two stainless steel cap screws (VFC No. 302 or equivalent.)

EXECUTION

A. SERVICE GROUND

1. Connect to following to service entrance ground bus:
   a. Commercial system's grounded neutral conductor.
   b. All "man-made" grounds (groundrods) specified to be installed.
   c. Service entrance equipment and all conduits entering and leaving equipment.
   d. Other items or equipment called for on drawings.
2. Current carrying capacity of grounding and bonding conductors shall conform to NEC Table 250-66 and/or plans (whichever is greater).

B. "MAN-MADE" GROUNDS - Man-made ground shall consist of three ground rods in triangular pattern with no two rods closer than 20'-0" to each other. Connect rods with continuous buried ground conductor. Man-made ground shall be tested with approved measuring device, such as "Vibroground", in order to verify that resistance does not exceed specified level.

C. EQUIPMENT AND WIRING DEVICE GROUND

1. Install grounding conductors for all equipment and wiring devices. Do not rely on conduit for grounding path.

2. Multiple circuits sharing single raceway may share single grounding conductor if all of following requirements are met:
   a. All circuits originate in same panel.
   b. No more than three single pole circuits may share ground conductor.
   c. Size ground conductor for largest circuit.

D. GROUNDING SYSTEM TESTING AND CERTIFICATION – Ground resistance measurements shall be taken using "Fall-of-Potential," 3-Point Measurement method using AEMC Instruments Model 3620 tester or equivalent. Results shall be recorded in Fall-of-Potential Plot similar to that found at AEMC Instruments web site: (http://www.aemc.com/techinfo/forms/ground_resistance_testers/FRM-Fall-of-PotentialPlot.pdf). Measure ground resistance at:
   1. Man-made ground - ground rod closest to service entrance ground point.
   2. Service entrance ground bar.
   3. Any exterior equipment enclosures mounted at ground level or on housekeeping pads.

END OF SECTION 16450

SECTION 16460 - TRANSFORMERS

GENERAL

A. DESCRIPTION

1. This section describes general provisions, products, and methods of execution relating to transformers. Type, size, ratings, etc., shall be as shown on plans and in accordance with UL and NEMA standards.
2. Include all line and low voltage transformers in this and other Divisions of specifications, including items such as: Control, communications systems, lighting and power, distribution and signal systems transformers, whether furnished as integral component of item of equipment or separately provided.

A. QUALITY ASSURANCE

1. Transformers shall be of latest approved design as manufactured by nationally recognized manufacturer and be listed in UL and bear UL label.
2. These specifications are based upon equipment from Square D, General Electric, Siemens and Cutler-Hammer

B. SUBMITTALS - Provide shop drawing submittals in accordance with Section 16010. Additional information shall be provided as follows:

1. Manufacturer's shop drawings to show weights, dimensions, mounting arrangements, interconnecting diagrams, and electrical power requirements.
2. Furnish typical test data, including ratio, resistance, losses, sound level, applied voltage, induced voltage, temperature rise, impulse test and short circuit test.

C. BROCHURE OF EQUIPMENT - Provide brochure of equipment with all operation and maintenance information in accordance with Section 16010. Include log of voltage measurements for each transformer.

D. WARRANTY - Warrant all components, parts and assemblies against defects in materials and workmanship in accordance with Section 16010.

PRODUCTS

A. TRANSFORMERS

1. All transformers shall be dry-type, except where specifically noted on plans.
2. Except as specifically noted on drawings, single phase transformers shall be 480 volt primary and 120/240 volt secondary. Three phase transformers shall be 480 volt delta primary and 120/208 volt wye secondary. Transformers 25 KVA and larger shall have minimum of four 2-1/2% full capacity primary taps unless noted otherwise.
3. Transformers 15 KVA and above shall be 150 degrees C temperature rise above 40 degrees C ambient. All insulating materials shall be in accordance with NEMA ST201972 standards for 220 degrees C UL component recognized insulation system.
4. Transformer coils shall be of continuous wound construction and shall be impregnated with non-hygroscopic, thermo-setting varnish.
5. All cores shall be constructed of high grade, non-aging silicon steel with high magnetic permeability, and low hysteresis and eddy current losses. Magnetic flux densities are to be kept well below saturation point. Core laminations shall be clamped together with structural steel angles. Complete core and coil shall then be bolted to base of enclosure but isolated by means of rubber, vibration-absorbing mounts. There shall be no metal-to-metal contact between core and coil and enclosure. On transformers 500 KVA and smaller, vibration isolating system shall be designed to provide permanent fastening of core and coil to enclosure. Sound isolating systems requiring complete removal of all fastening devices are not acceptable.
6. Transformers 15 KVA and larger shall be in heavy gauge, sheet steel, ventilated enclosure. Ventilating openings shall be designed to prevent accidental access to live parts in accordance with UL, NEMA, and NEC standards for ventilated enclosures. Single phase transformers 15 KVA through 167 KVA, and three phase transformers

through 112.5 KVA shall be designed so they can be either floor or wall mounted. Larger transformers shall be designed only for floor mounting.

7. Entire transformer enclosure shall be de-greased, cleaned, phosphatized, primed, and finished with gray, baked enamel.
8. Maximum temperature of top of enclosure shall not exceed 50 degrees C rise above 40 degrees C ambient.
9. Core of transformer shall be visibly grounded to enclosure by means of flexible grounding conductor sized in accordance with applicable NEMA, IEEE, AND ANSI standards.
10. Transformer shall be listed by UL for specified temperature rise.

EXECUTION

A. MOUNTING - Coordinate with General Contractor to provide and install 6" reinforced concrete housekeeping pad under pad-mounted transformers.

B. ADJUSTMENT - On multi-tap transformers, adjust transformer taps to provide rated voltage at secondary bus with all connected loads "on", except no-load secondary line-to-neutral voltage shall not exceed 125 volts. Submit log of final voltage readings.

C. ELECTRICAL CONNECTIONS - Flexible metal conduit with supplemental ground jumper shall be used for all transformer connections. Flexible conduit shall be installed in slack, shallow "U" form. Ground jumper in flexible conduits may be either within or bonded to exterior of conduit.

END OF SECTION 16460

SECTION 16470 - PANELBOARDS

GENERAL

A. DESCRIPTION - This section describes general provisions, products, and methods of execution relating to branch circuit panelboards. Type, size, ratings, etc., shall be as shown on plans and in accordance with UL Standards 50 and 67.

B. SPECIAL REQUIREMENTS - Special features such as main contactor, submain contactor, split bus, feed-thru lugs, TVSS, etc., shall be provided as called for on plans.

C. QUALITY ASSURANCE

1. Panelboards shall be of latest approved design as manufactured by nationally recognized manufacturer and be listed in Underwriters' Laboratories and bear UL label.
2. These specifications are based upon equipment from Square D, General Electric, Siemens and Cutler-Hammer.

D. SUBMITTALS - Provide shop drawing submittals in accordance with Section 16010.

E. BROCHURE OF EQUIPMENT - Provide brochure of equipment with all operation and maintenance information in accordance with Section 16010. In addition, provide photo copy of each panelboard circuit directory.

PRODUCTS

A. CABINETS AND FRONTS

1. CABINET WIDTHS

a. Unless noted otherwise, all panelboard assemblies shall have **minimum** enclosure widths as follows:

Sub-BreakerSizes	Minimum Cabinet Width
60A or smaller	20”
Greater than 60A	24”

b. Minimum cabinet widths shall be increased as required to allow for side wire bending space as follows:

Largest Sub-Breaker in Panel	Minimum Wire Bending Space on Side
15A to 20A	3”
25A to 60A	5”
70A to 100A	7.5”
110A to 200A	10”
225A	11”
Greater than 225A	13.5”

2. Unless noted otherwise, cabinets shall include door-in-door type fronts.
3. Doors shall include brushed stainless steel, cylinder tumbler-type locks with catches and spring-loaded door pulls. All panelboard locks shall be keyed alike.
4. Trims shall be furnished to be compatible with type of mounting.
5. Fronts shall be adjustable including trim clamps which shall be completely concealed when doors are closed. Doors shall be mounted by completely concealed steel hinges. Dead-fronts shall not be removable with door in locked position. Fronts shall be of code gauge, full finished steel with rust-inhibiting primer and baked enamel finish.
6. All feed conduit(s) shall enter from bottom of panel.
7. Circuit directory frame and card shall be in accordance with Section 16050.
8. Cabinets shall be labeled in accordance with drawing and Section 16050.

B. SAFETY BARRIERS - Panelboard interior assembly shall be dead front with panelboard front removed.

C. BUS ASSEMBLY - Panelboard bus structure and main lugs or main breaker shall have current ratings as shown on panelboard schedule. Bus bars shall be either copper or aluminum as specified on panel schedule.

D. SHORT CIRCUIT RATING - Each panelboard, as complete unit, shall have short circuit rating equal to or greater than that shown on panelboard schedule. If none is shown, minimum is 10,000 AIC symmetrical at 240 volts, 14,000 AIC symmetrical at 460 volts.

E. PROTECTION DEVICES - Circuit breakers shall individually comply with Section 16475 Overcurrent Protective Devices. Type to be furnished shall be as shown on plans. All breakers in individual panel shall conform to minimum AIC symmetrical for panel.

F. NEUTRAL TERMINAL AND EQUIPMENT GROUNDING TERMINALS - All panelboards shall be equipped with insulated neutral terminal bar. Un-insulated equipment grounding terminal bar shall be furnished to terminate equipment grounding conductors.

EXECUTION

A. Verify mounting arrangements and clearance for each location shown on plans.

B. In general, all conduits shall enter top or bottom of panel.

C. Provide additional wire gutters or pull boxes to facilitate orderly entry of conduits into cabinets. Bundle and support wires and arrange them in orderly manner in designated wire gutters.

D. Panelboards shall not be used for pull boxes for wiring not terminating in panelboard.

E. Label panelboards in accordance with Section 16050.

F. EXTERIOR INSTALLATIONS

1. To allow for snow removal, coordinate with General Contractor to provide and install 6" reinforced concrete pad under exterior panelboards. Pad shall be finished with non-slip surface. It shall extend 12" on each side of panelboard and shall extend 42" out from front of panel.
2. Coordinate with General Contractor to ensure that building roof eves are arranged so that water will not drip directly onto panelboard. This may also be accomplished using rain gutters.

END OF SECTION 16470

SECTION 16475 - OVERCURRENT PROTECTIVE DEVICES

GENERAL

A. DESCRIPTION - This section describes general requirements, products, and methods of execution relating to overcurrent protective devices. Type, duty rating and characteristics, fault interrupting capability and coordination requirements shall be determined from plans and following specifications.

B. RELATED WORK - Contractor shall thoroughly examine Section 16660 Ground Fault Protection System which contains related information.

C. QUALITY ASSURANCE

1. Devices shall be latest approved design as manufactured by nationally recognized manufacturer and in conformity with applicable standards and UL listings.
2. Circuit breaker manufacturer shall match panelboard manufacturer and shall be product of Square D, General Electric, Siemens or Cutler-Hammer.
3. Fuses shall be Bussmann or equivalent in Littelfuse or Ferraz-Shawmut.

D. SUBMITTALS - Provide shop drawing submittals in accordance with Section 16010. Additional information shall be provided as follows:

1. Catalog designation with model number for each device.
2. Trip curves for each device.
3. Series ratings for circuit breakers where applicable.

E. BROCHURE OF EQUIPMENT - Provide brochure of equipment with all operation and maintenance information in accordance with Section 16010.

PRODUCTS

A. MOLDED CASE CIRCUIT BREAKERS

1. Molded case circuit breakers shall be suitable for individual as well as panelboard mounting. Bolt-on type only. No breakers designated "plug-on" type allowed.
2. Breakers shall meet current NEMA and UL specifications as applicable to frame size, standard rating and interrupting capability.
3. Breakers shall be one-, two-, or three-pole as scheduled, operate manually for normal ON-OFF switching and automatically under overload and short circuit conditions.
4. Operating handle shall open and close all poles simultaneously on multi-pole breaker. Operating mechanism shall be trip-free so that contacts cannot be held closed against abnormal overcurrent or short circuit condition. Do not use single-pole circuit breakers with handle ties where multi-pole breakers are indicated.
5. Breakers shall be of type noted on panel schedule (shunt-trip, GFCI, etc.) or as required by equipment being provided.
   a. Breakers noted as GFI protected for equipment shall have 30mA trip.
   b. Breakers noted as GFI protected for personnel shall have 6mA trip.

B. FUSES

1. Fuse types shall be as follows (unless otherwise specified):

PROTECTED EQUIPMENT	ELECTRICAL CHARACTERISTICS	UL CLASS	FUSE TYPE	BUSSMANN NUMBER
Main switch, panelboard, feeders and branch circuits	0-600A, 250V AC	RK1	Dual-element, Time-delay	LPN-RK
	0-600A, 600V AC	RK1	Dual-element, Time-delay	LPS-RK
H.I.D. light fixtures	0-30A, 600V AC	--	Fast acting	KTK w/HPF or HEB fuse holder

2. Fuses of sizes recommended by equipment manufacturer or as specified on drawings shall be installed. Fuses shall be capable of interrupting prospective symmetrical fault current.
3. Furnish one complete set of spare fuses of each rating installed to Owner. Provide removable label, on all spare fuses, indicating with which equipment they are to be used. Provide fuse puller(s) for fuse sizes used.

EXECUTION

A. Size devices as shown and specified, or as required by load being served. Where fusing in accordance with manufacturer's guidelines requires smaller fuses and reducers, Contractor shall provide them with no additional cost to Owner.

B. Provide phenolic label on interior of every fusible switch. Label to read "Replace with LPJ-400SP fuses only" or as appropriate for size and type of fuse as specified or installed.

C. Provide any adjusting or programming of breakers as required to allow proper protection of loads served.

END OF SECTION 16475

SECTION 16510 - LIGHT FIXTURES, ACCESSORIES AND HARDWARE

GENERAL

A. DESCRIPTION - This section describes general requirements, products and methods of execution relating to lighting fixtures and associated hardware, lamps, ballasts, etc. Note that items covered in this section may be covered in various schedules on drawings including, but not limited to: Light Fixture Schedule, Exterior Light Fixture Schedule, Lamp Schedule, Pole Schedule, Track Lighting Hardware Schedule, etc.

B. QUALITY ASSURANCE

1. Fixture shall be standard catalog item as described on drawings and as made by nationally recognized manufacturer.
2. All fixtures shall bear UL label and be listed for intended location and use. Fixture Schedule is general guide to type, quality and other characteristics. Fixtures of equivalent or greater quality and performance characteristics may be substituted as noted on Fixture Schedule. Any fixtures or manufacturers not noted for substitution on Fixture Schedule shall be subject to approval prior to bid.

C. JOB CONDITIONS - Contractor shall investigate drawings of all disciplines and existing conditions which may affect fixture mounting and conduit routing. Contractor shall arrange fixtures and equipment to avoid interference with existing conditions or work of other crafts. In event that it becomes necessary to make field changes in fixture locations or mounting methods due to building construction, Contractor shall consult with Architect before making any changes. Any such changes required shall be made without added cost to Owner.

D. SUBMITTALS - Provide shop drawing submittals in accordance with Section 16010. Submittals shall include:

1. Detailed cut sheets for fixtures indicating configuration, color, all hardware and options to be provided.
2. If fixture color is to be chosen by architect, submit color samples.
3. Cut sheets for lamps being provided.
4. Foot-candle calculations for pole mounted fixtures.
5. Weight and EPA for pole mounted fixtures.
6. Windload information for pole configurations.
7. List of all parts necessary for particular installation configuration.

E. SAMPLES - Where, in Engineer/Architect's opinion, product sample is required in order to determine appearance, quality, workmanship or operation, Contractor shall submit actual production samples of fixture in question.

F. BROCHURE OF EQUIPMENT - Provide brochure of equipment with all operation and maintenance information in accordance with Section 16010.

PRODUCTS

A. GENERAL

1. All fixtures with magnetic or hybrid ballasts shall be equipped with individual in-line fusing.
2. All fixtures with integral ballasts shall have ballast installed and pre-wired at factory.
3. Fixture pendants, canopies, blank sections, end caps, corners, tees, etc. shall be finished to match their respective fixture.
4. Each fixture, lamp and ballast combination shall be altered as required to ensure that fixture will properly function in its environment as listed in Local Site Conditions, Section 16010. Notify Engineer of any alterations required.

B. LAMPS

1. HIGH INTENSITY DISCHARGE LAMPS - Metal halide lamps for interior fixtures shall be clear, high output type designed for lamp orientation required.

2. SPARE LAMPS - Spare lamps shall be provided in quantities of 10% of total lamps of each type installed. Quantity of spares shall not be less than four (4) spare lamps for any one lamp type.

C. BALLASTS
1. BALLASTS FOR HIGH INTENSITY DISCHARGE LAMPS
a. Ballasts shall be of regulator type (constant wattage). Ballast shall be high power factor (95%) and operate lamp satisfactorily with voltage variation of plus or minus 13%.
b. Outdoor ballasts shall be rated for operation in minimum of -20 degrees F.

D. HIGH INTENSITY DISCHARGE (H.I.D.) FIXTURES
1. All metal halide fixtures shall be totally enclosed, except where specifically noted otherwise.
2. Unless noted otherwise, enclosed H.I.D. fixtures shall employ charcoal filtering.

E. EXTERIOR LIGHT FIXTURES - Fixtures shall be provided as described in Exterior Fixture Schedule on plans.
1. Gasketing shall be employed on any exterior lensed fixtures to avoid accumulation of bugs.
2. All fixtures shall be fused. Fusing shall be integral with fixture except with pole-mounted fixtures where fusing shall be located in hand-hole at base of pole.
3. Each fixture, lamp, ballast and pole combination shall be altered as required to ensure that fixture will properly function in its environment as listed in Local Site Conditions, Section 16010. Notify Engineer of any alterations required.

F. POLES - Poles shall be provided as described in Pole Schedule on plans. Pole bases shall be provided and installed in accordance with details on plans.
1. Unless otherwise noted under "Local Conditions" in Section 16010, all pole and fixture configurations shall be designed to withstand constant wind loads of 100 mph with gusts up to 130 mph. Pole gauge and diameter may differ from manufacturer to manufacturer. Driving requirements are EPA and allowable fixture weight.
2. Unless otherwise noted, all poles taller than 20' shall be tapered. Vibration dampers shall be provided for aluminum poles 20' tall or greater and steel poles 30' tall or greater.
3. All poles shall be provided with hand hole at 18" above base. Provide hand hole finish plate.
4. Unless noted otherwise, pole finish shall match fixture finish whether anodized or powder coated.
5. Provide all poles complete with bolt circles, anchor bolts, nuts, bolt covers, tenons, fixture mounting hardware, etc., as required for complete installation.

EXECUTION

A. GENERAL
1. Contractor shall provide and install all mounting hardware required to conform with mounting conditions.
2. Fixtures shall be installed level, plumb and true. Rows of fixtures shall be aligned accurately in three dimensions.

B. EXTERIOR FIXTURE INSTALLATION
1. Provide concrete base for poles as detailed on plans.
2. Set poles in place, plumb and anchor firmly to base.
3. Poles shall be grounded with #8 AWG or larger continuous bare copper wire connected to equipment grounding system.
4. Grout pole base after aligning pole.
5. Aim adjustable fixtures at night to provide optimum light coverage.

C. LAMP/BALLAST BURN-IN – Contractor shall deactivate any automatic timer, photocells or motion sensors and shall leave all lamps on for 80 to 100 hour period prior to completion of

work. This allows lamps and ballasts to be burned-in and will help to identify problem ballasts and lamps so that they can be replaced.

END OF SECTION 16510